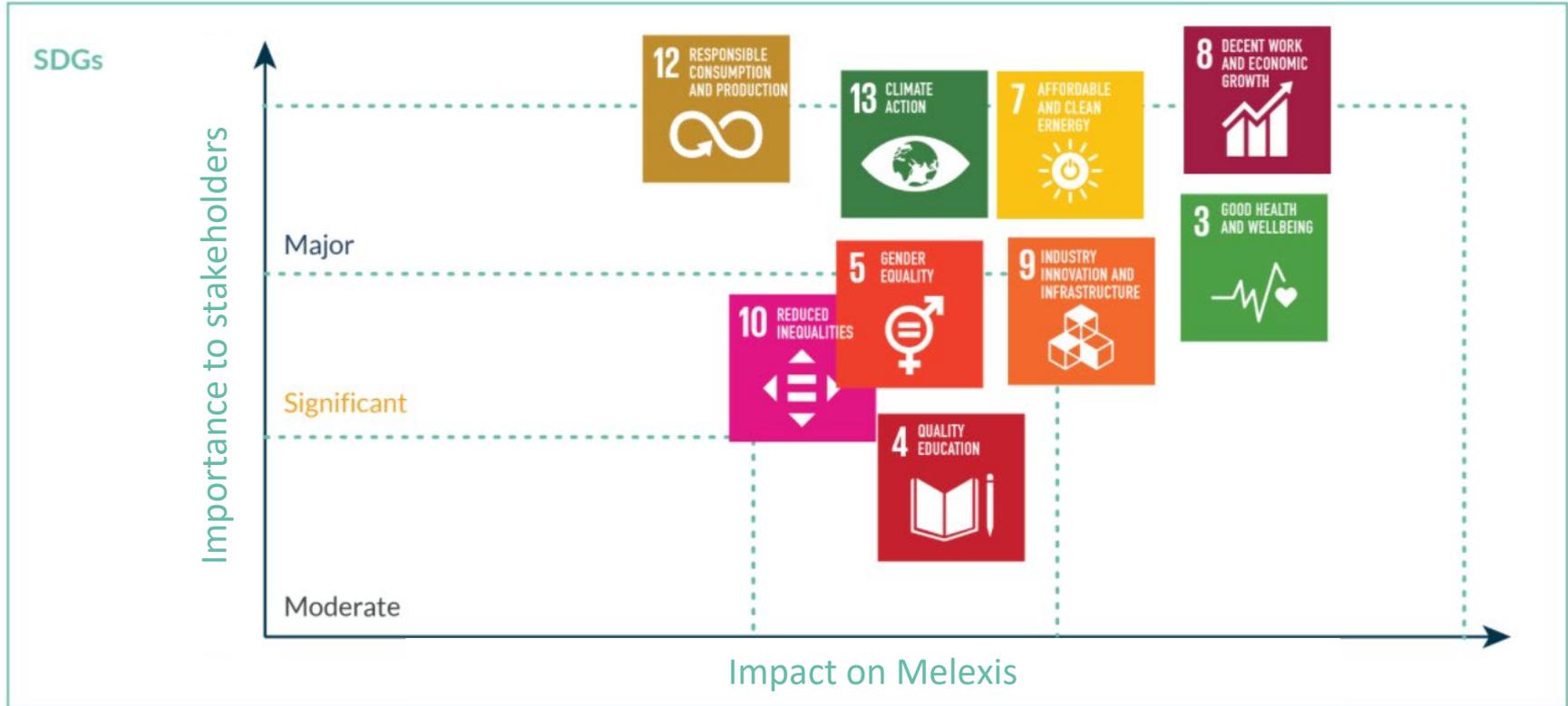
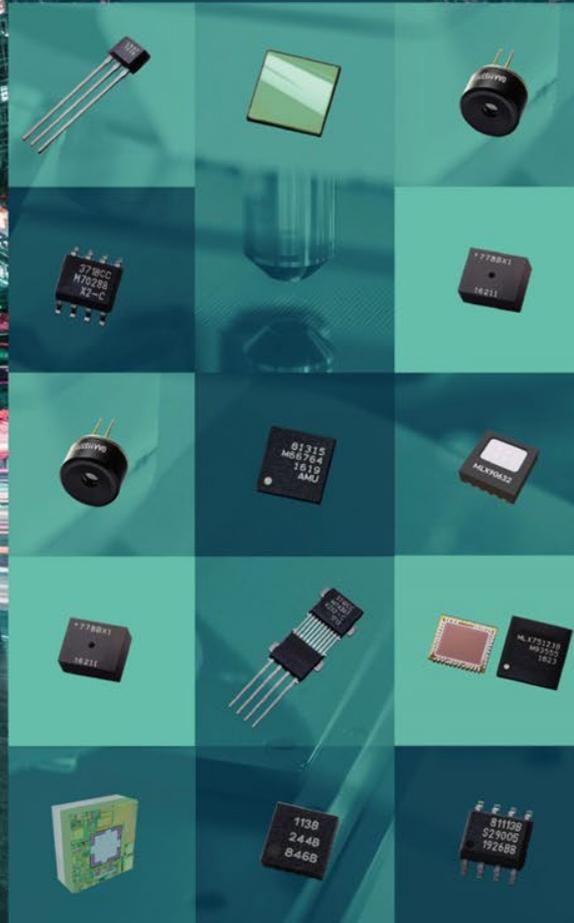


# Sustainable Development Goals (SDGs)



# MELEXIS ICs SHAPE THE FUTURE



# MELEXIS ICs SHAPE THE FUTURE



## PLANET



ELECTRIFICATION



MICRO MOBILITY



THERMAL MANAGEMENT



## PEOPLE



USER EXPERIENCE



SAFETY



HEALTH



# Agenda

<b>14:00</b>	Welcome	Françoise Chombar
<b>14:05</b>	Melexis ICs Shape the Future	Marc Biron
<b>14:10</b>	Planet Centric Solutions Product Line and Regional presentations	Vincent Hiligsmann
<b>15:00</b>	BREAK	
<b>15:05</b>	People Centric Solutions Product Line and Regional presentations	Damien Macq
<b>15:30</b>	Supply Chain update	Veerle Lozie
<b>15:40</b>	Wrap-up	Marc Biron
<b>15:45</b>	Q&A in break-out rooms	
<b>16:15</b>	End	

# MELEXIS ICs SHAPE THE FUTURE



## PLANET



ELECTRIFICATION



MICRO MOBILITY



THERMAL MANAGEMENT



# MELEXIS ICs SHAPE THE FUTURE



## PLANET



ELECTRIFICATION



MICRO MOBILITY



THERMAL MANAGEMENT



# MELEXIS ICs SHAPE THE FUTURE



## PLANET



ELECTRIFICATION



MICRO MOBILITY



THERMAL MANAGEMENT



# Automotive - From 10 to 20 (ICs/car) – How?

## Maximize ICE Greenification

*Low-emission Vehicles  
feat. an Internal Combustion Engine*

## Master Networked Lighting

*Interior & Exterior*

**POWERTRAIN**



**CHASSIS - BODY - SAFETY**

## Strengthen Electrification

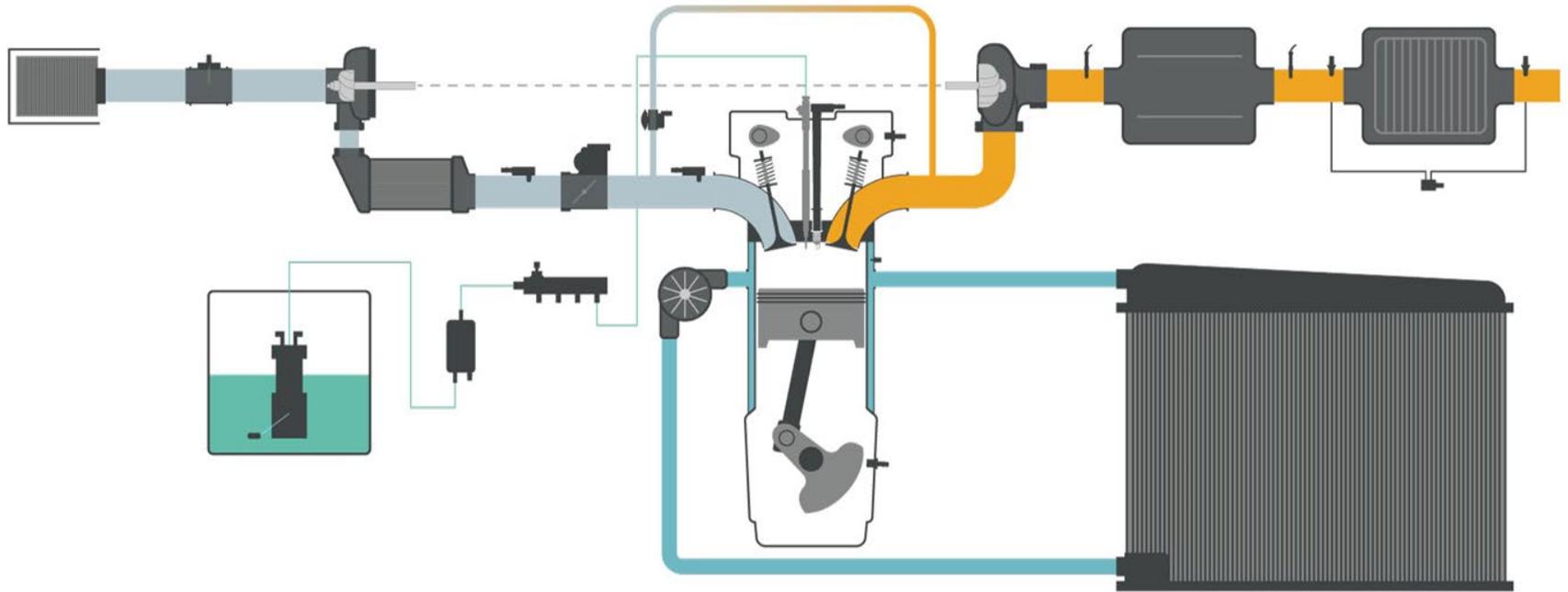
*Hybrid & Electric Vehicles*

## Serve Automotive Innovation

*Mechatronic, Intelligent Vehicles*

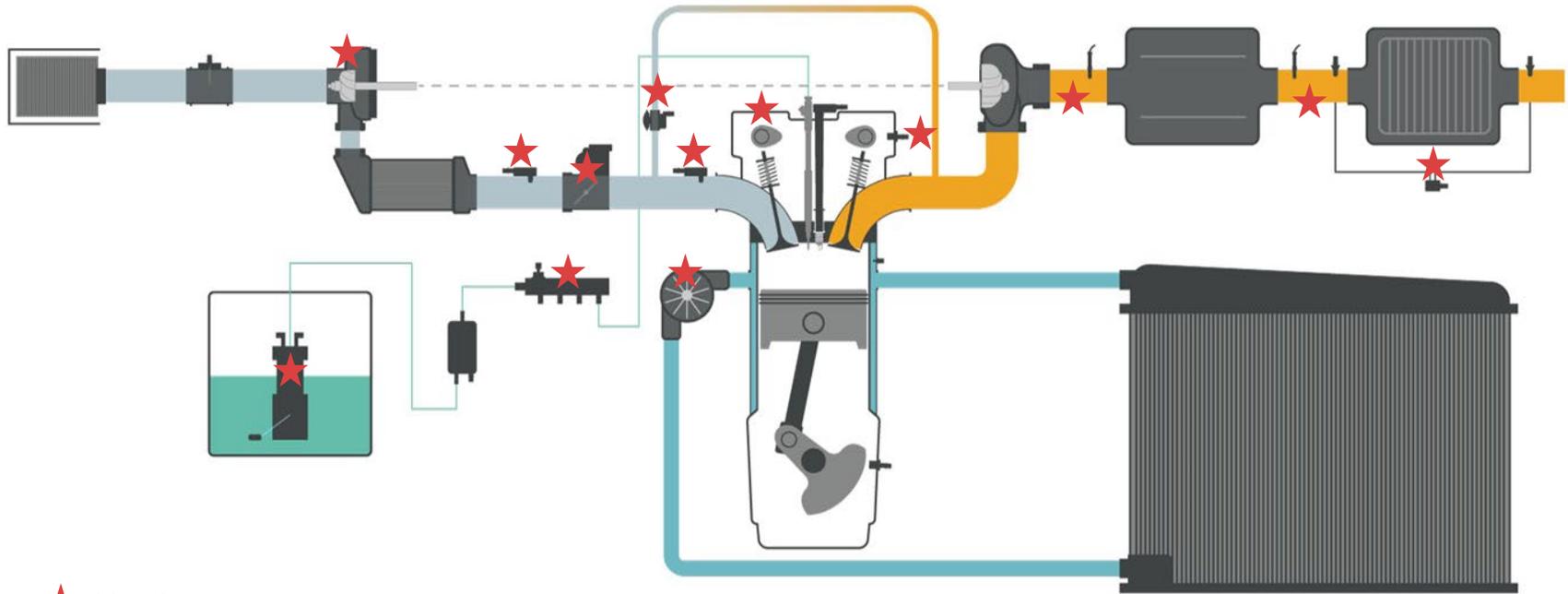
# Automotive - From 10 to 20 (ICs/car)

Melexis products in ICE



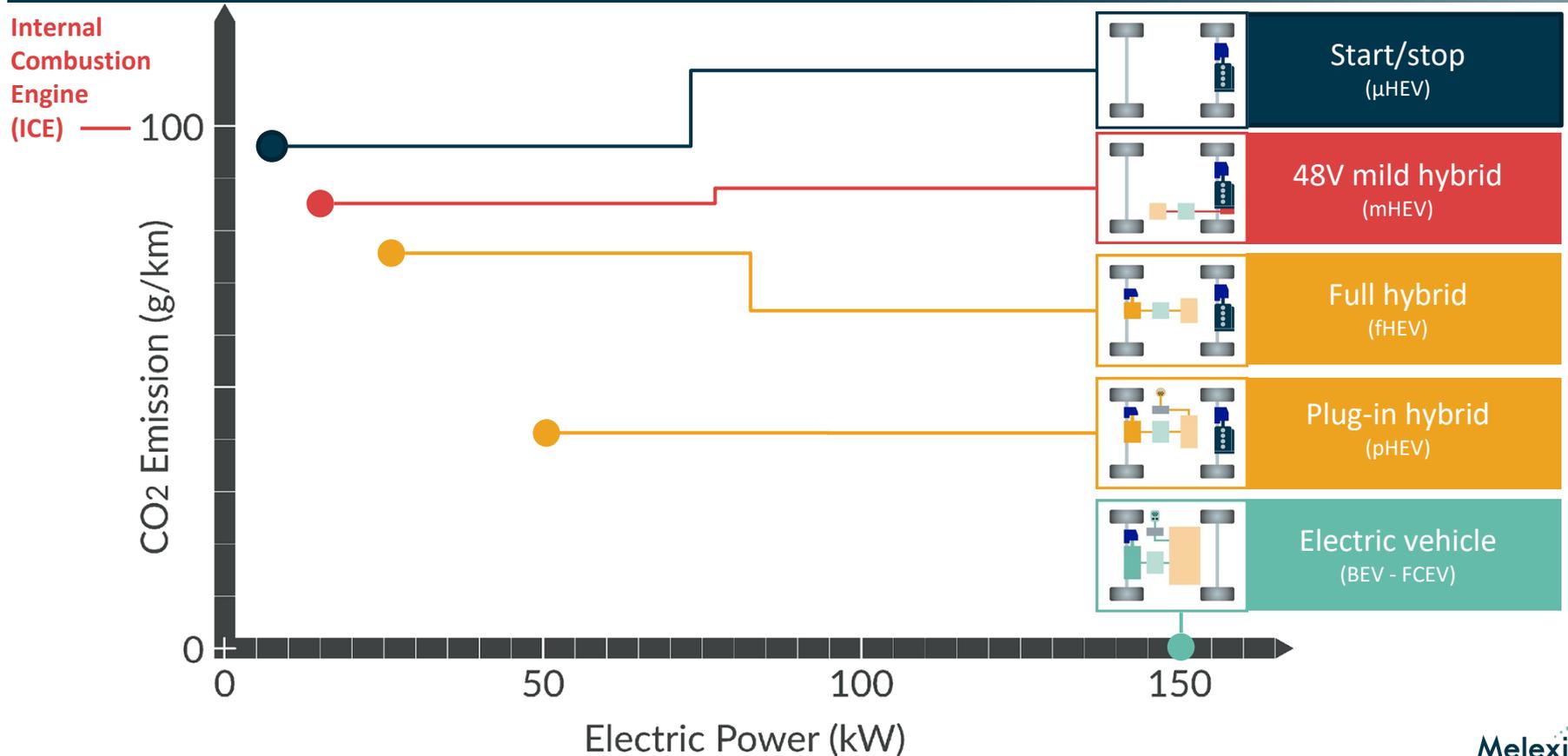
# Automotive - From 10 to 20 (ICs/car)

Melexis products in ICE

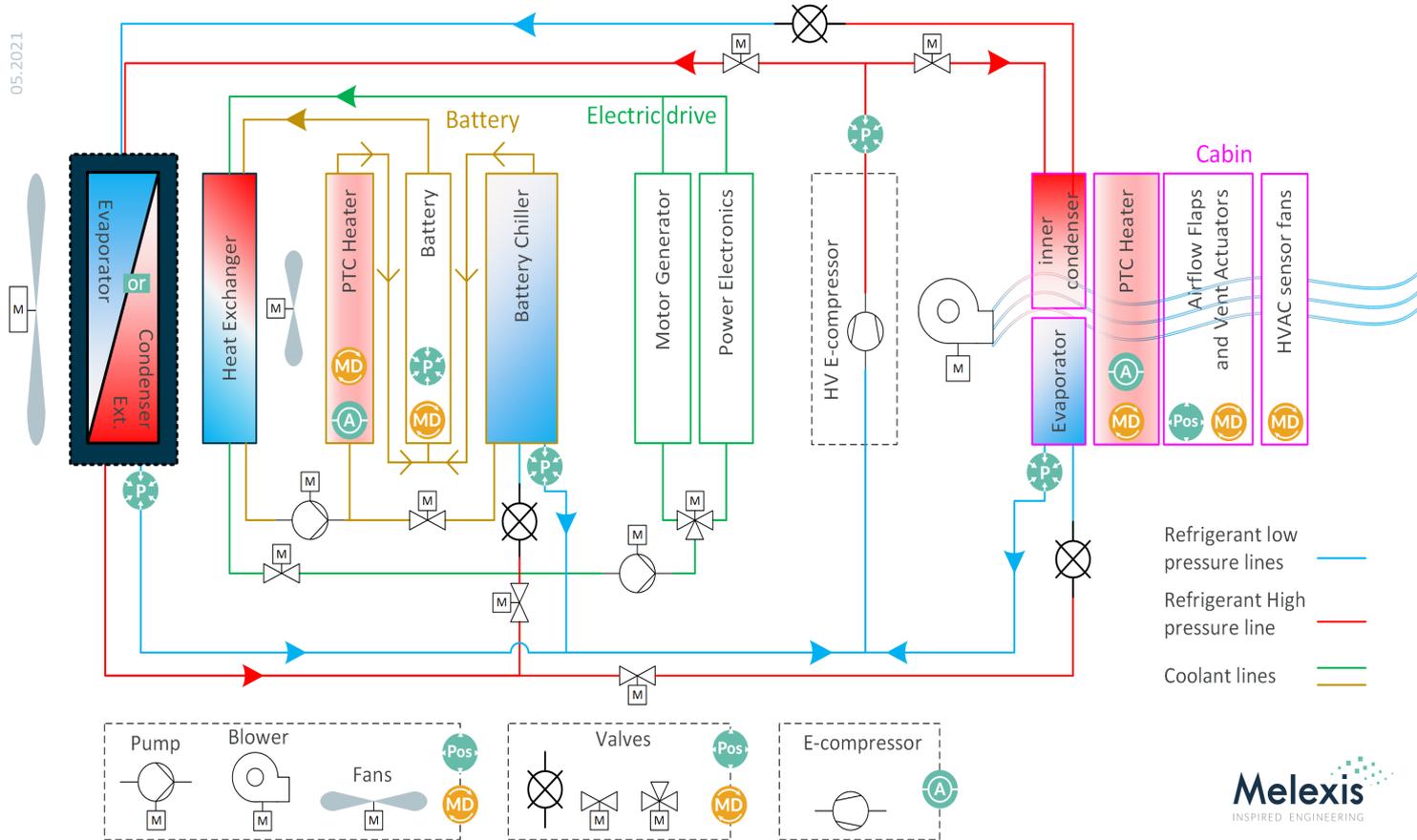


★ Melexis product

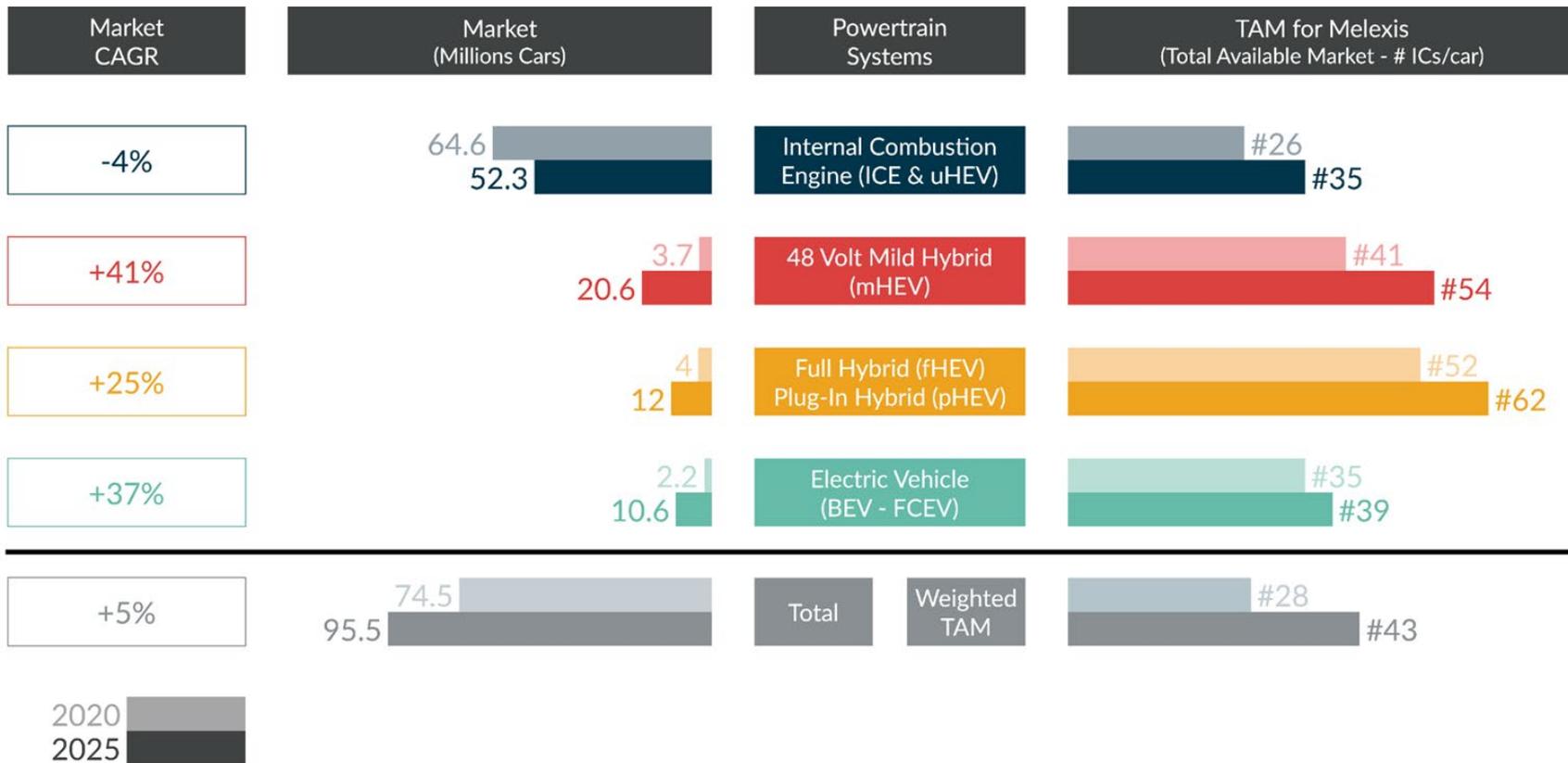
# Automotive - From 10 to 20 (ICs/car)



# Thermal management of a Battery Electric Vehicle



# Evolution addressable sockets 2020-2025



# Adjacent - From 10 to 20 (%Revenue) – How?



## Alternative Mobility

*2–3 wheelers, e-mobility, micro-delivery, robotaxis, AGVs...*



## Carbon-neutral

*smart appliances, smart buildings, non-fossil energy, smart metering,...*



## Well-being

*health, medical, wearable, gaming...*



## Robotics

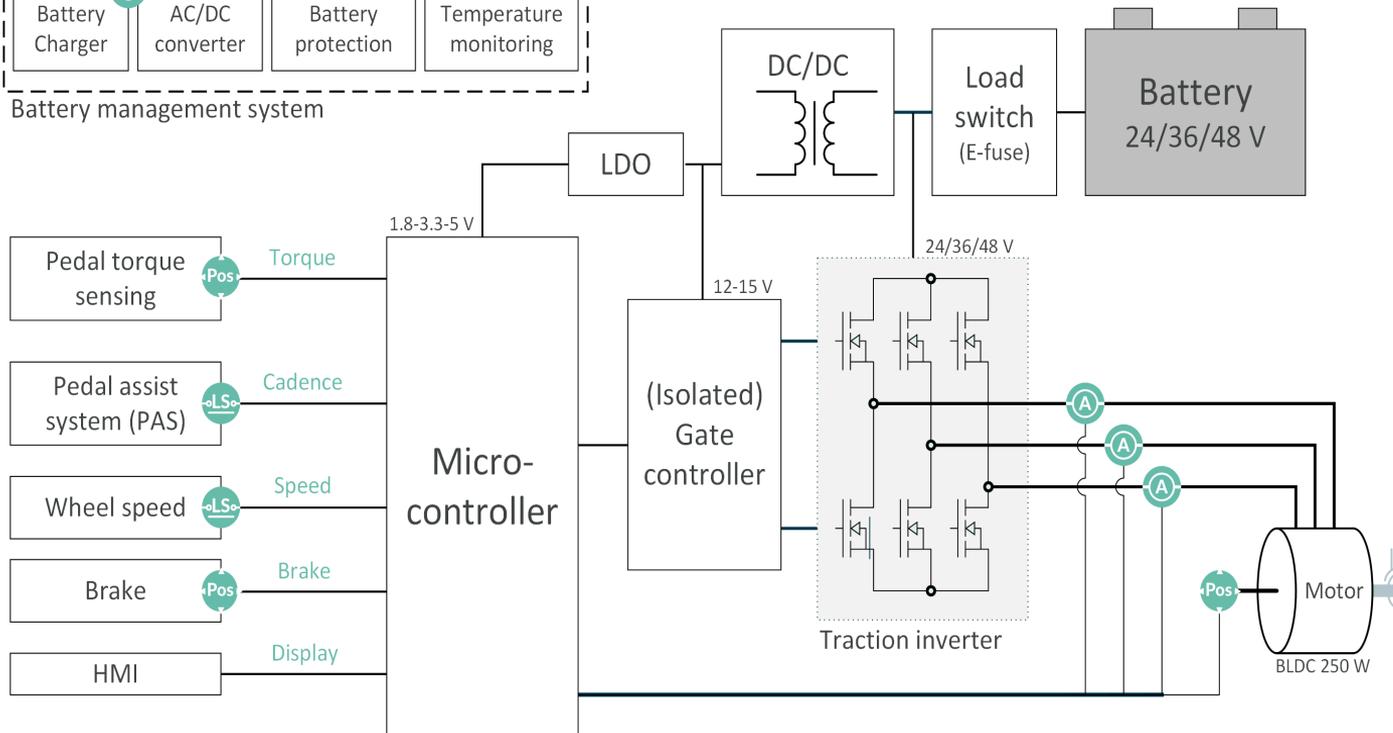
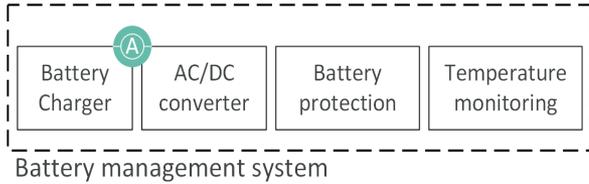
*automation, assisting, social interaction...*

## Computing & Networking

*cooling, power management...*



# Power electronics of an E-bike



05.2021

- Position sensor
- Latch & switch
- Current sensor

# In summary

## Automotive

**Maximize ICE Greenification**  
Low-emission Vehicles  
feat. an Internal Combustion Engine



**Strengthen Electrification**  
Hybrid & Electric Vehicles



## Adjacent



### Alternative Mobility

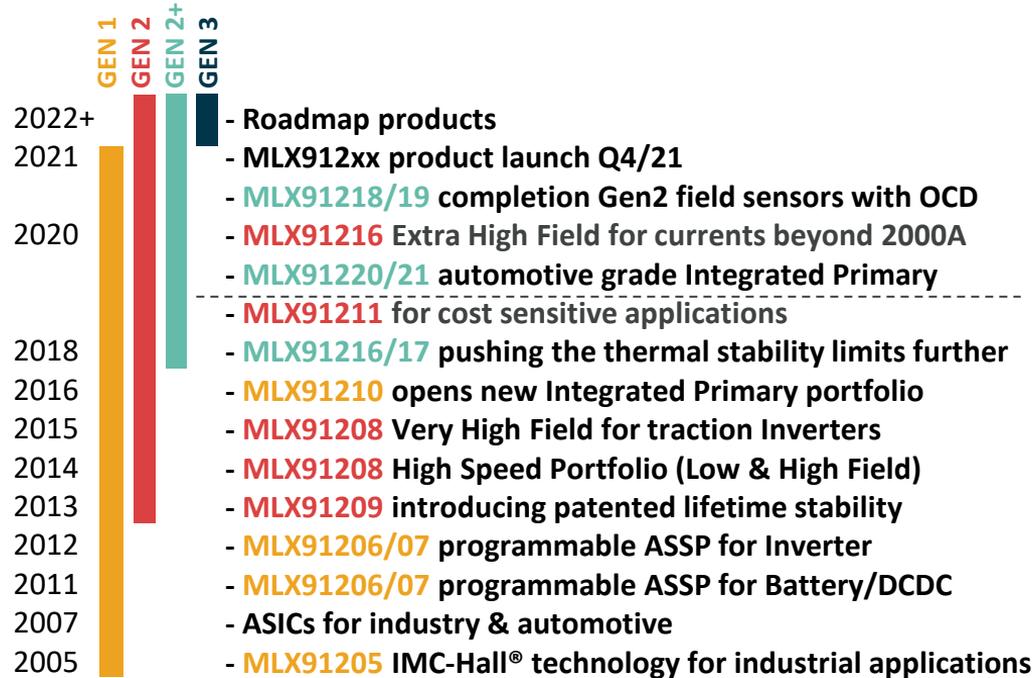
2-3 wheelers, e-mobility, micro-delivery, robotaxis, AGVs...



### Carbon-neutral

smart appliances, smart buildings, non-fossil energy, smart metering,...

# Current sensors



## Broad Hall effect sensor portfolio

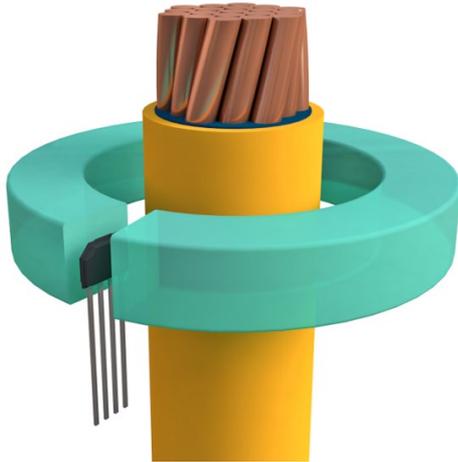
- 2nd Generation on the market designed in at nearly all OEMs
- Proprietary IMC-Hall® technology brings advantages for designers
- Market leading sensor accuracy (thermal & lifetime)

# Current sensors



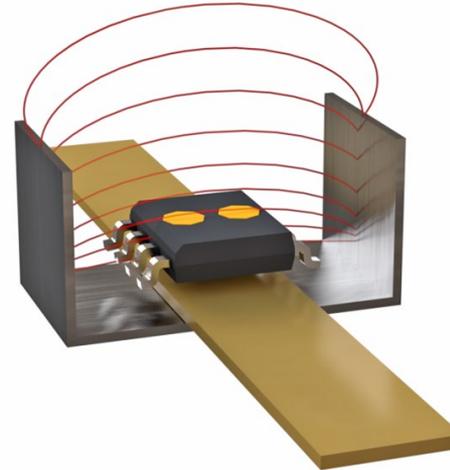
## Conventional Hall

MAX >10kA



## IMC-Hall®

MAX >2kA



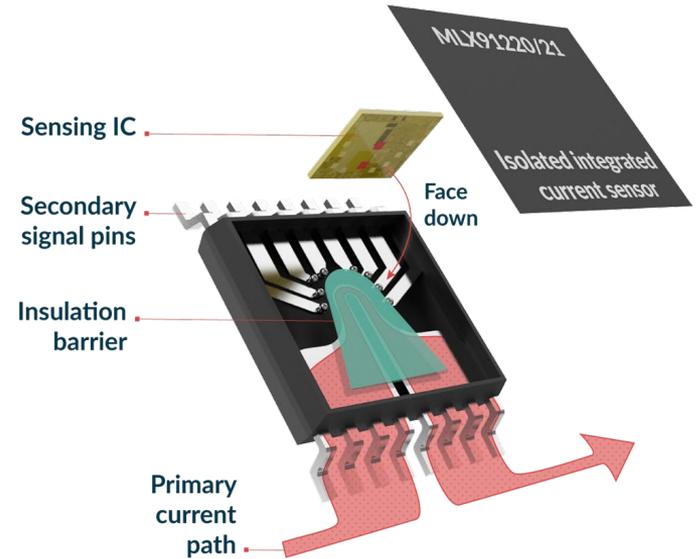
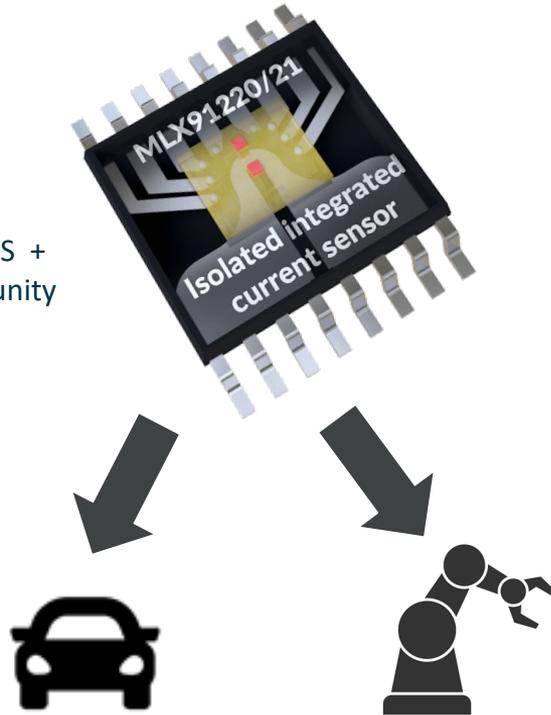
Downsizing & easier  
integration + lighter



# Current sensors



Ultimate Integration: CMOS +  
isolation + stray field immunity



# Current sensors



## Fit for adjacent markets

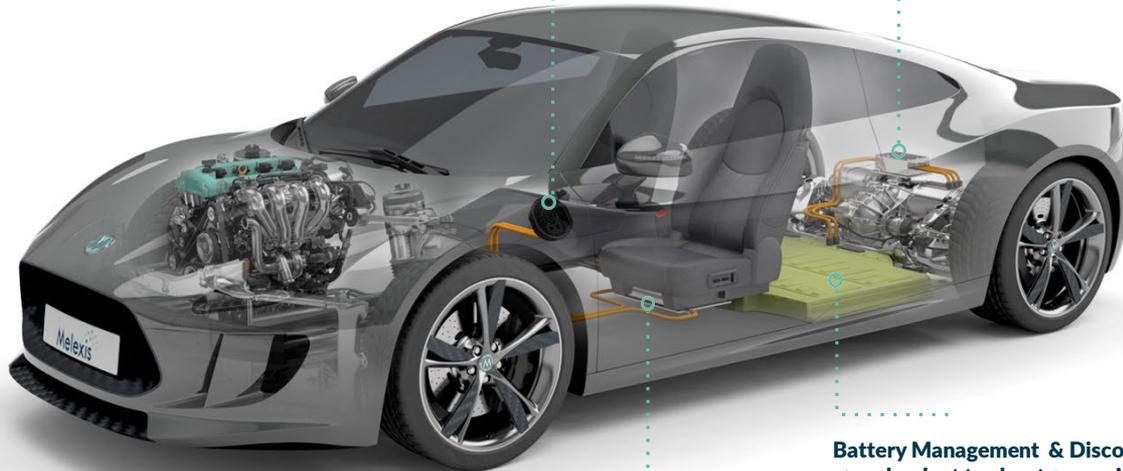
- Industry electric motor control (automation) and automotive traction motor control have very similar requirements → single product development amortization
- Solar market is volatile, but under permanent growth in the green energy mix
- Plug & Power portfolio is ultimate integration for <50A

# Current sensors



**OBC = on-board charger**  
→ now addressable with  
MLX91220/21

**INV = traction/boost inverter**  
(eAxe, 48V BSG, ...)  
→ maintain leading position, ongoing  
development



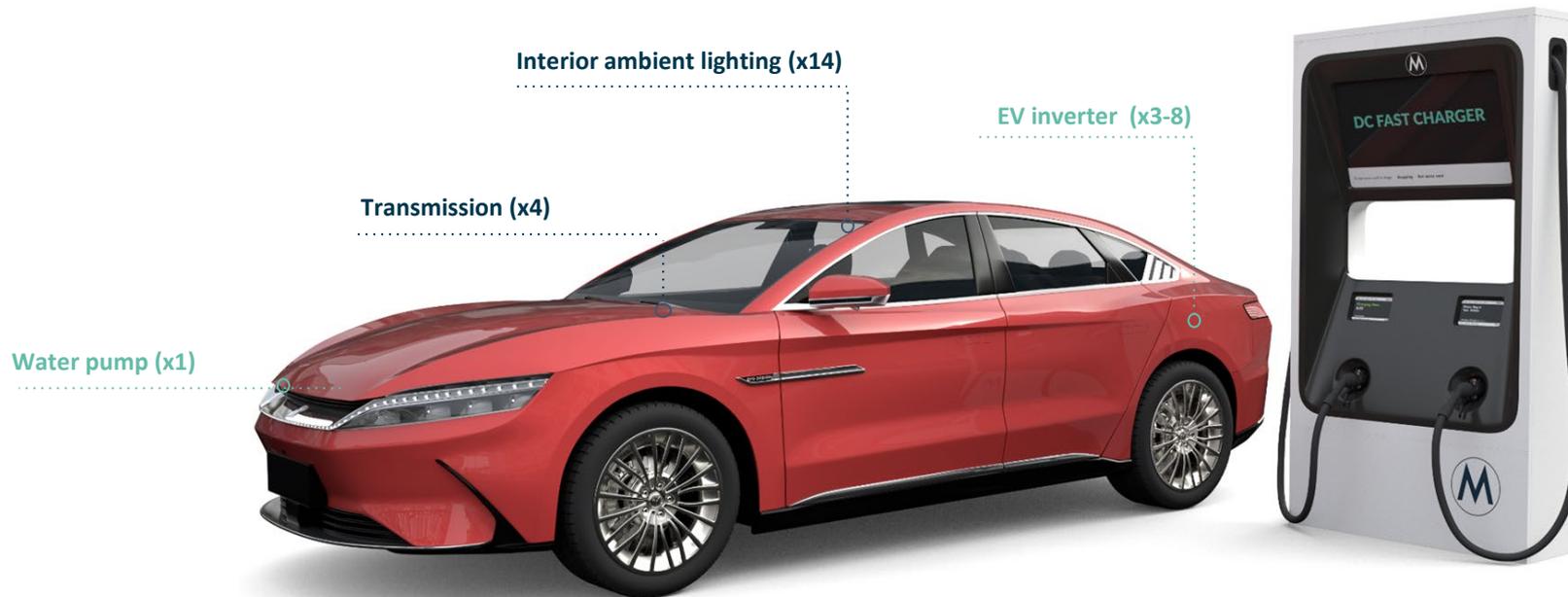
**DCDC converter**  
→ HV side now addressable with  
MLX91220/21

**Battery Management & Disconnect**  
→ redundant to shunt + ongoing  
development

**PTC heater & HV compressor**  
→ now addressable with  
MLX91220/21

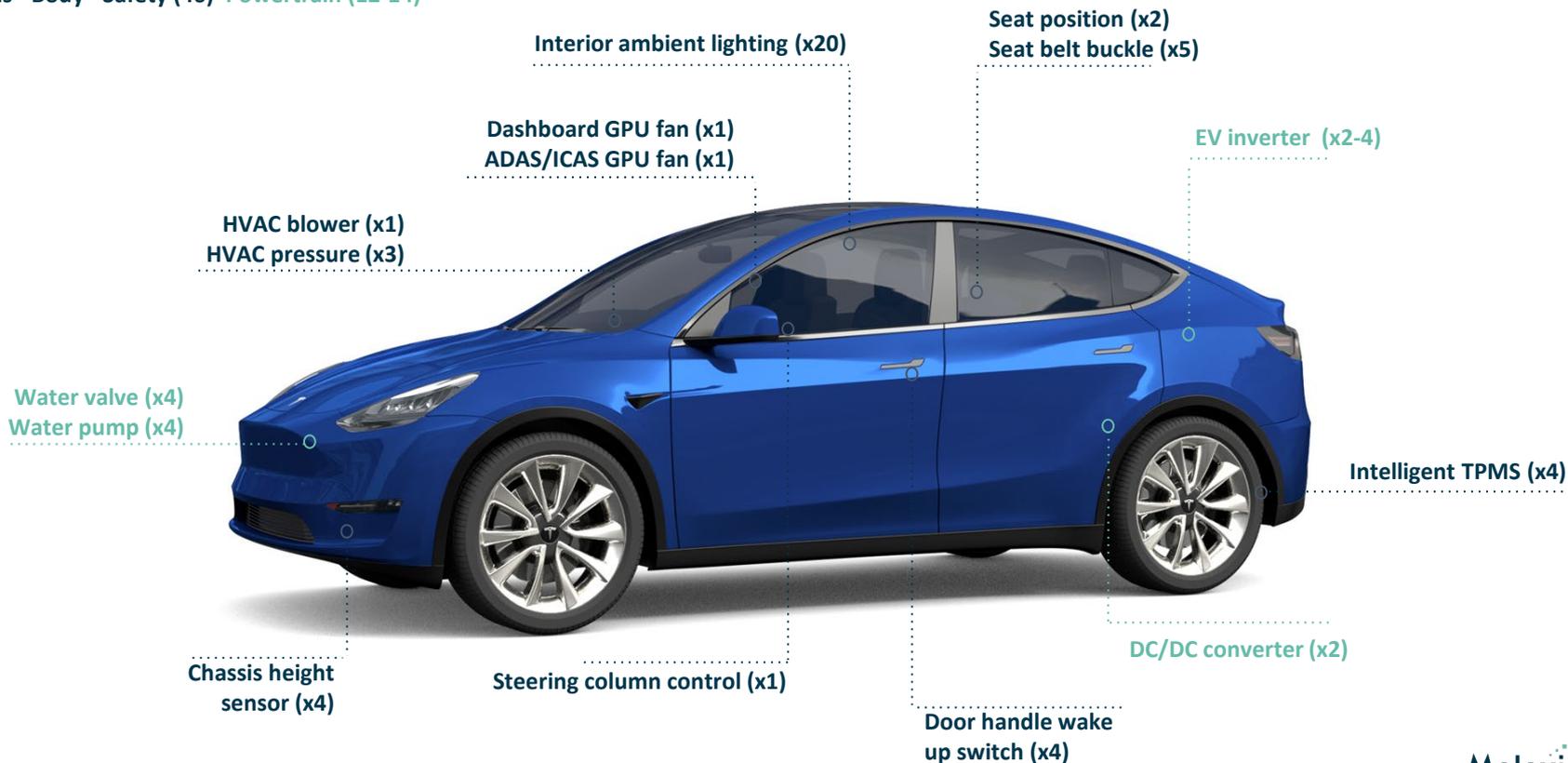
# BYD Han / BYD Dynasty Series 王朝系列

Chassis - Body - Safety (18) Powertrain (4-9)



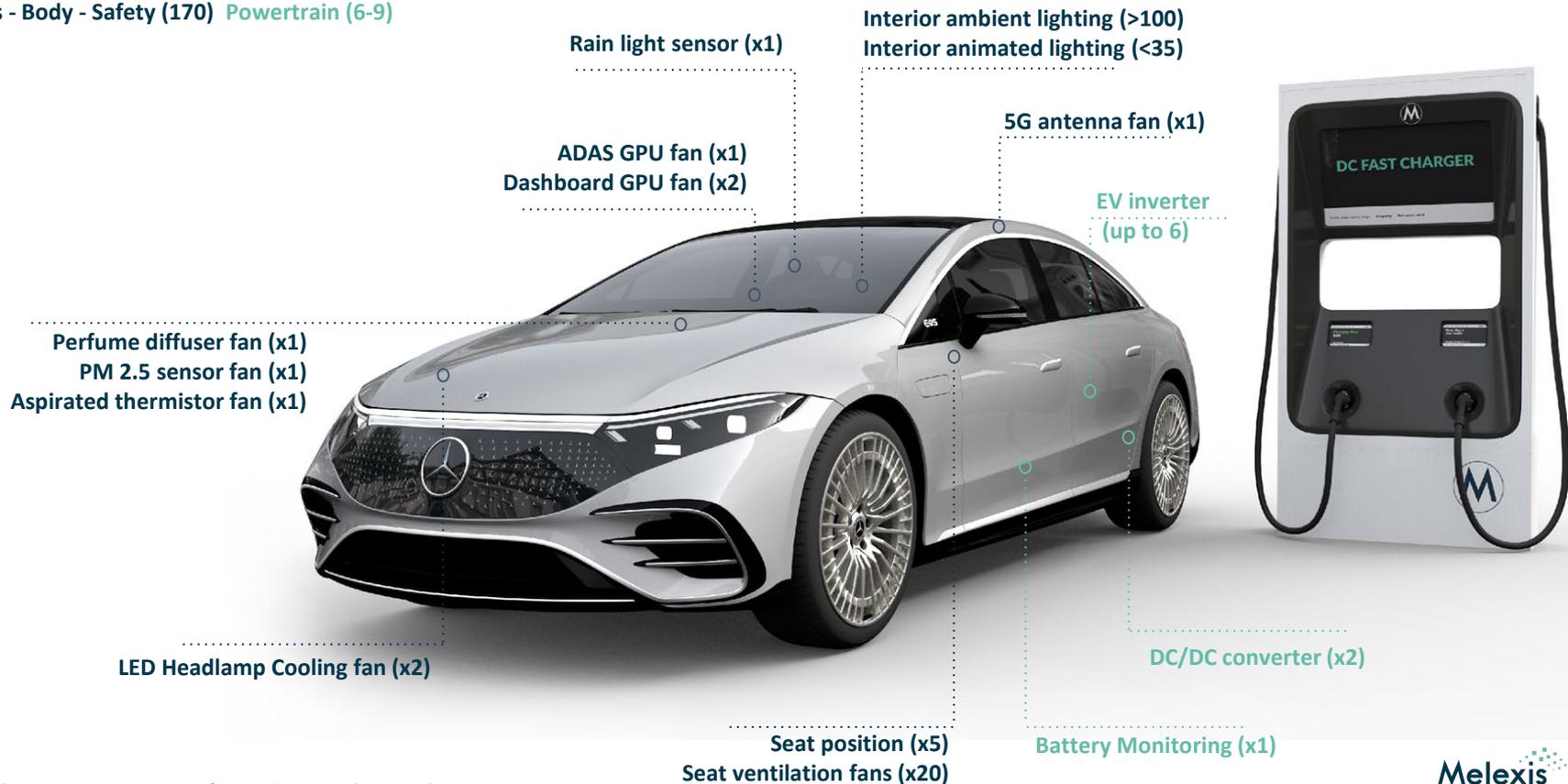
# Tesla Model Y / Models X, S and 3

Chassis - Body - Safety (46) Powertrain (12-14)



# Mercedes EQS / S-Class

Chassis - Body - Safety (170) Powertrain (6-9)



# Volkswagen ID.3/MEB

Chassis - Body - Safety (>28) Powertrain (4)



\* estimation

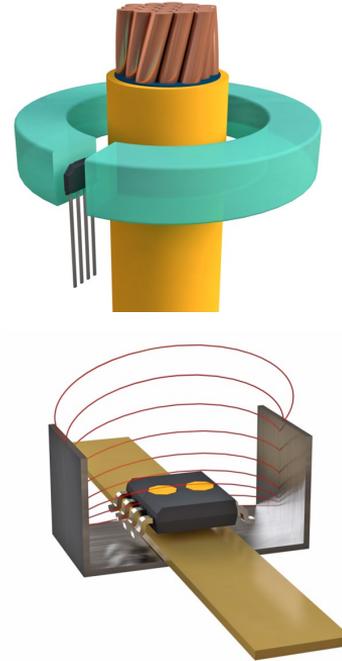
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# Current sensors

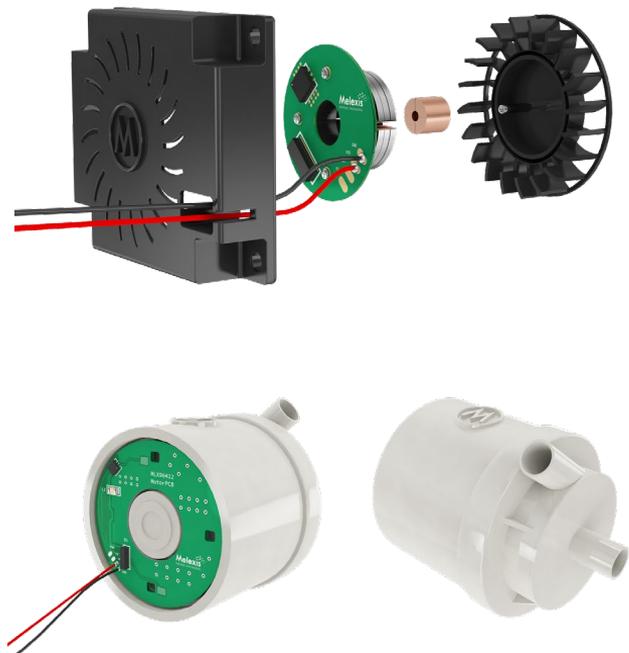
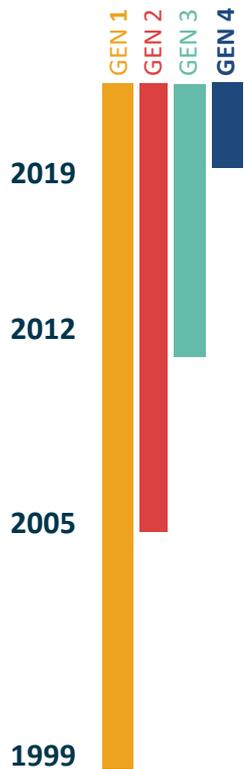


## Conclusion

- 1 Automotive in major growth
- 2 New products unlock access to new applications: OBC, DCDC HV, PTC, ...
- 3 Addressing broad industrial market of electric drives, solar, power supplies, chargers and consumer market for demand/load control and white goods



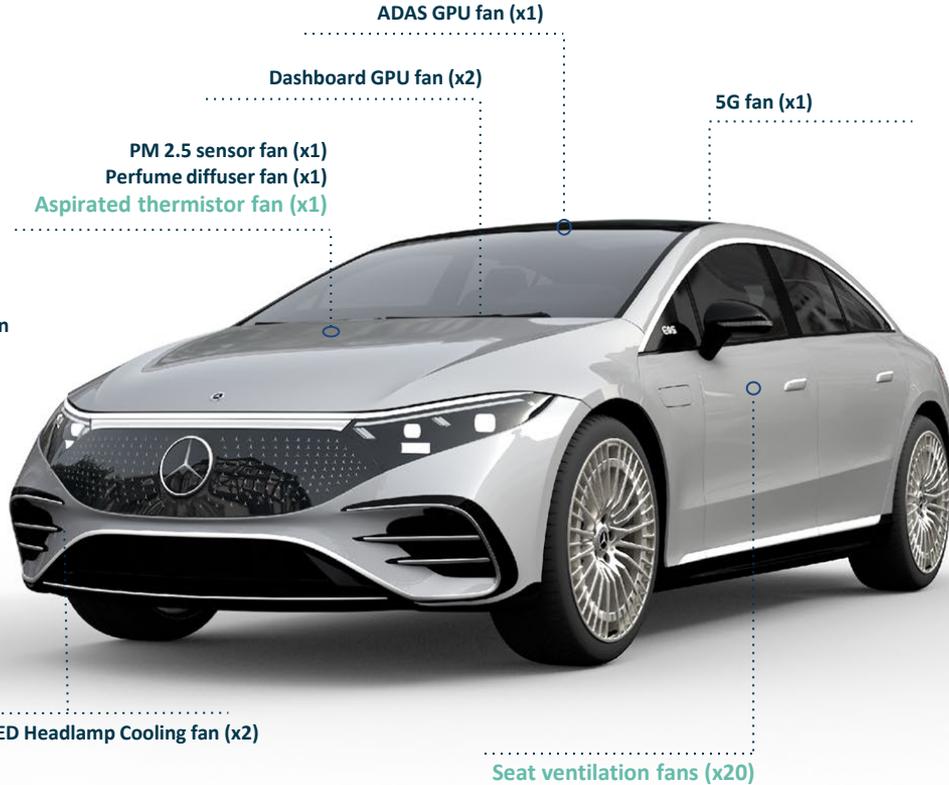
# Smart drivers



## Unique areas of expertise

- State of the art acoustic noise / vibration
- Robust operation over a long life time
- Plug and play

# Smart drivers



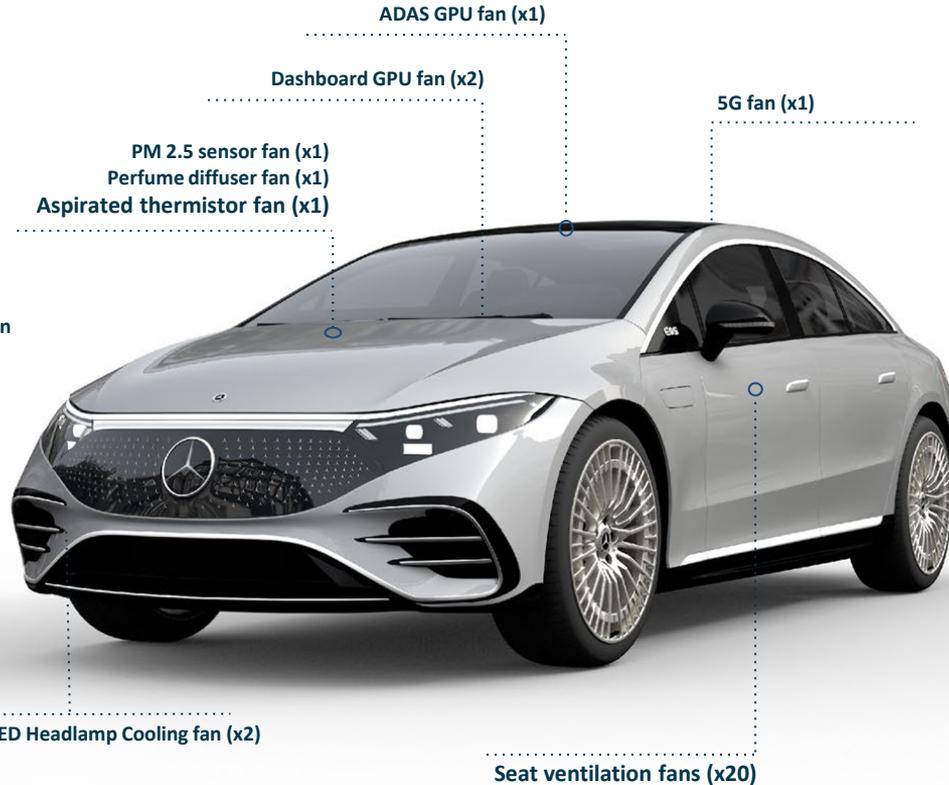
## Other automotive applications:

- Domain controller cooling fan
- Wireless cell phone charger
- Battery cooling fan
- DC/DC cooling fan
- Inverter cooling fan
- Auxiliary water pump
- Humidity sensor fan
- Neck warmer fan
- Air scarf fan
- Ozone diffuser fan
- Air ionizer fan
- Seat massage pump



Refrigerators

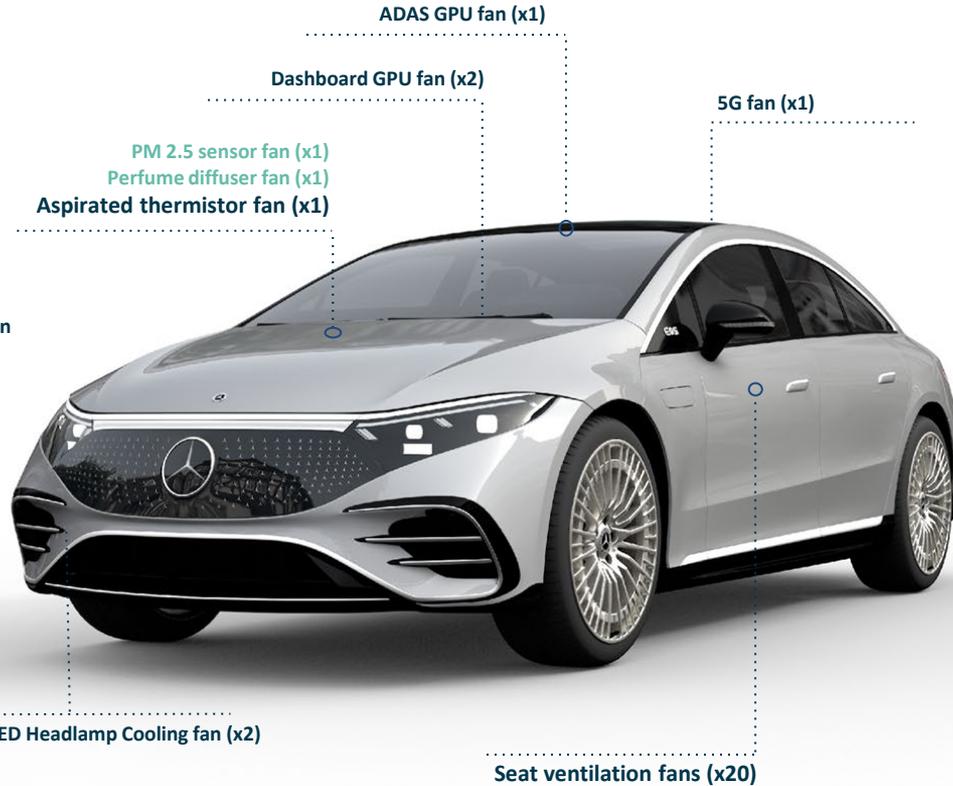
# Smart drivers



## Other automotive applications:

- Domain controller cooling fan
- Wireless cell phone charger
- Battery cooling fan
- DC/DC cooling fan
- Inverter cooling fan
- Auxiliary water pump
- Humidity sensor fan
- Neck warmer fan
- Air scarf fan
- Ozone diffuser fan
- Air ionizer fan
- Seat massage pump

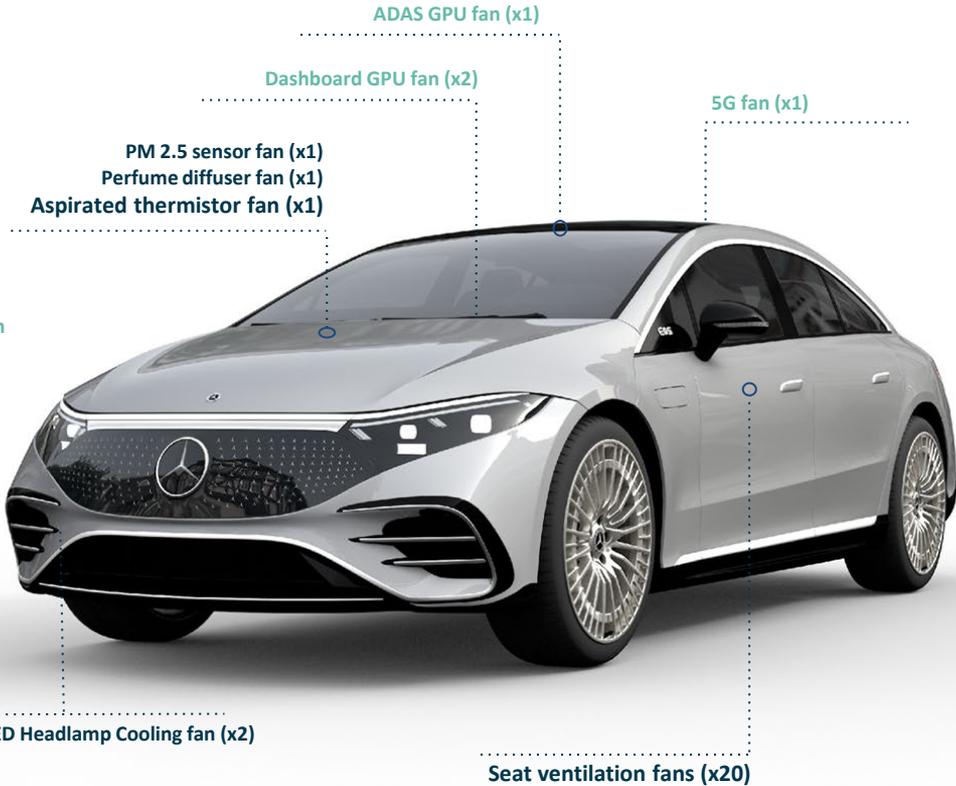
# Smart drivers



- Other automotive applications:
- Domain controller cooling fan
  - Wireless cell phone charger
  - Battery cooling fan
  - DC/DC cooling fan
  - Inverter cooling fan
  - Auxiliary water pump
  - Humidity sensor fan
  - Neck warmer fan
  - Air scarf fan
  - Ozone diffuser fan
  - Air ionizer fan
  - Seat massage pump



# Smart drivers



- Other automotive applications:
- Domain controller cooling fan
  - Wireless cell phone charger
  - Battery cooling fan
  - DC/DC cooling fan
  - Inverter cooling fan
  - Auxiliary water pump
  - Humidity sensor fan
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  - Ozone diffuser fan
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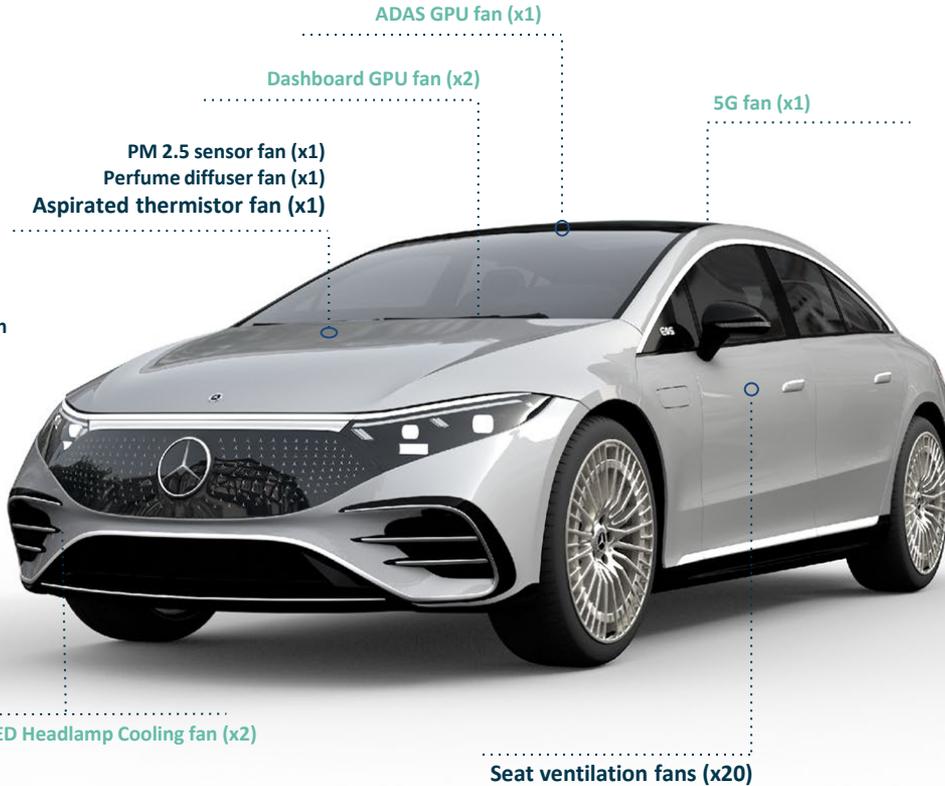
VGA cards



Desktop fans



# Smart drivers



## Other automotive applications:

- Domain controller cooling fan
- Wireless cell phone charger
- Battery cooling fan
- DC/DC cooling fan
- Inverter cooling fan
- Auxiliary water pump
- Humidity sensor fan
- Neck warmer fan
- Air scarf fan
- Ozone diffuser fan
- Air ionizer fan
- Seat massage pump

# Smart drivers



Fuel pump



# Smart drivers

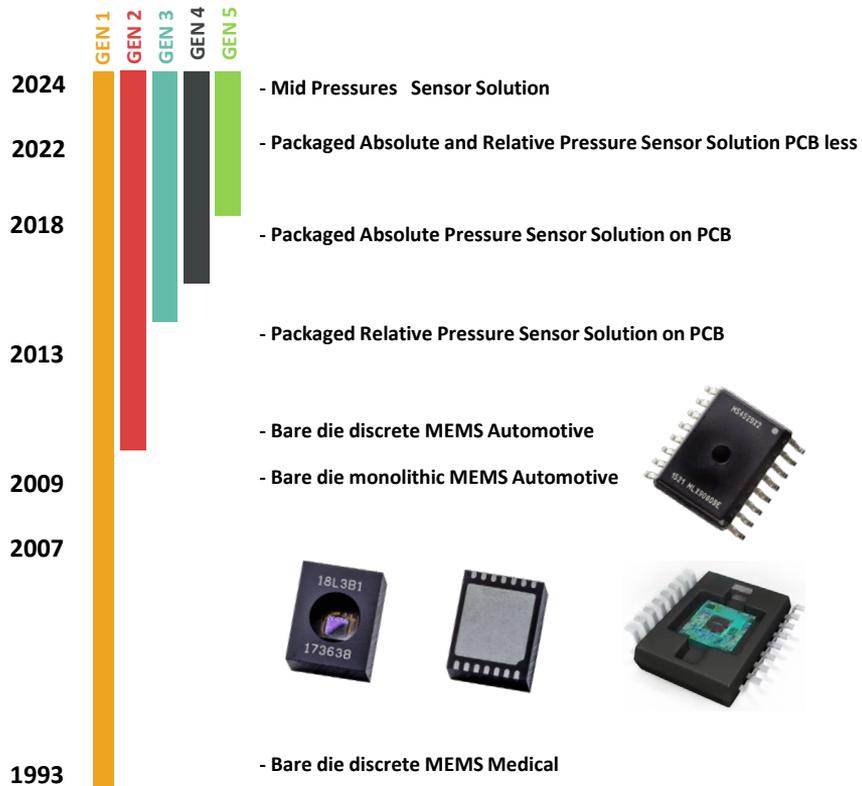


## Conclusion

- 1 Recognized market leader both in automotive and adjacent
- 2 Surfing all mega trends
- 3 On the path from 10 to 20 adjacent



# Pressure sensors



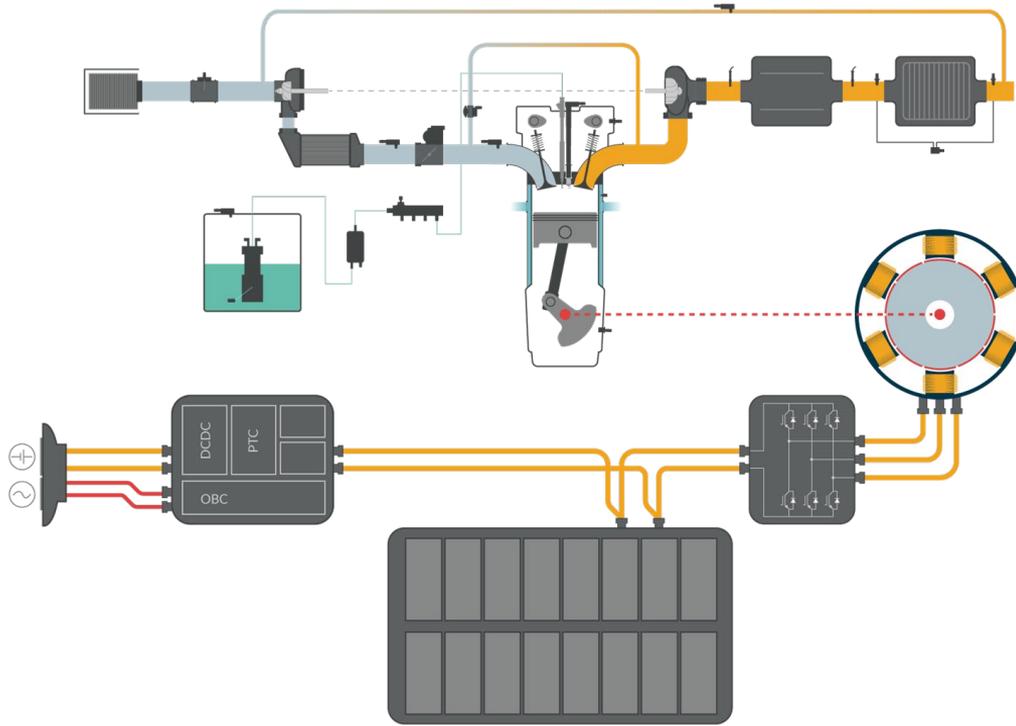
## Broad pressure sensor portfolio

- Absolute pressure
- Relative pressure
- Mid pressure
- Sensor interfaces

## Fit for multiple markets

- Primary focus on automotive powertrain for ICEs and hybrid vehicles
- Expanding market into thermal management of electric cars
- Expanding market to applications facing liquid media

# ICE/Hybrid



## Number of pressure sensors

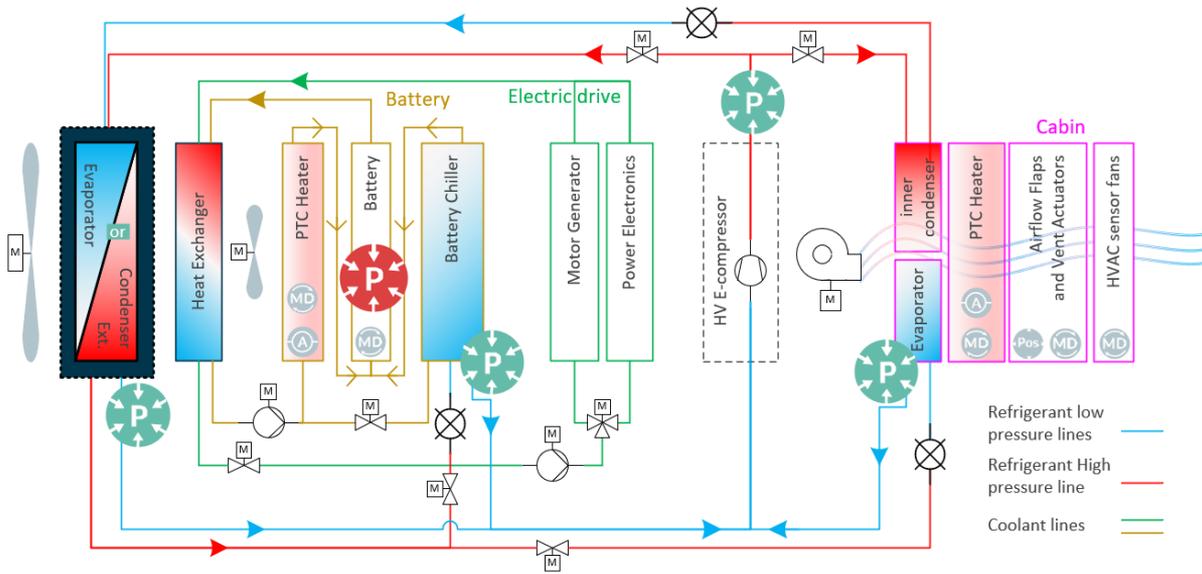
ICE: 5 - BEV: 1



ICE: 1 - BEV: 4



# xEV/Thermal Management



 Pressure sensor

## Number of pressure sensors

ICE: 5 - BEV: 1



ICE: 1 - BEV: 4



Refrigerant low pressure lines —  
 Refrigerant High pressure line —  
 Coolant lines —

# Pressure sensors



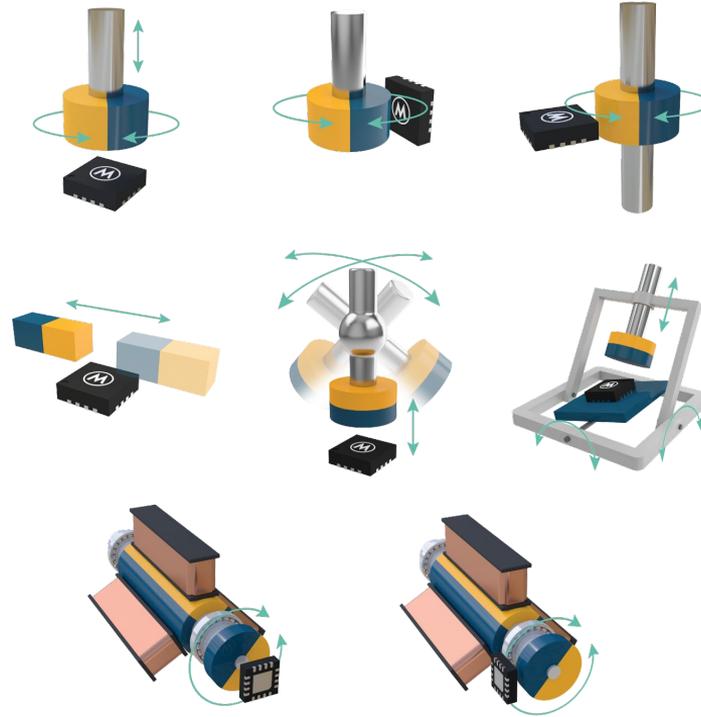
## Conclusion

- 1 Full solutions including MEMS, sensor interface, package & calibration
- 2 Strong focus on harsh media automotive requirements
- 3 Unmatched performance and robustness



## History

- Start 1989
- Offices in Belgium, Germany, France, Switzerland, Bulgaria and Ukraine
- Home-office based account managers
- More than 40 people actively support our customers in EMEA
- Powerful sales and application support network, including distributors and representatives



# EMEA

## Successes

- Custom ASICs and Triaxis 3D hall-effect sensors ignited the success in EMEA automotive
- Major platform wins at tier-1 and tier-2 companies
- Lead-customer concept
- Technology leadership in Hall-based position sensors and switches
- Interior RGB lighting pioneer
- Gesture control with time-of-flight



## Trends

### Electrification

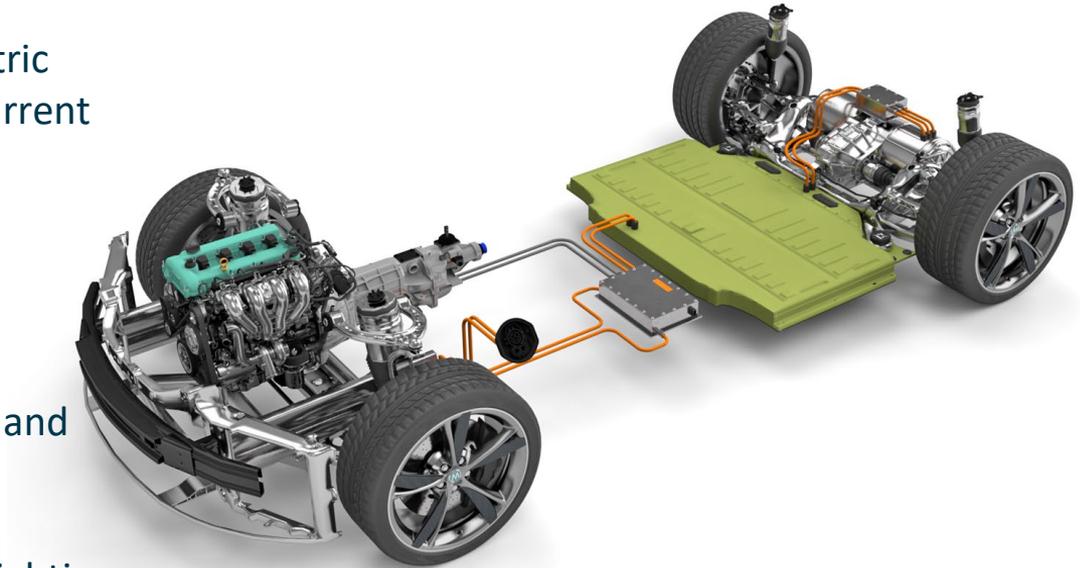
- Various forms (48V, hybrid, full-electric vehicles, e-bikes, e-scooters) with current sensors and inductive sensors
- Increasing vertical integration

### Personalization

- Interior lighting
- New players appearing
- Comfort actuators with Hall Sensors and motor controllers

### ADAS

- Time-of-flight and dynamic interior lighting



# APAC

## History

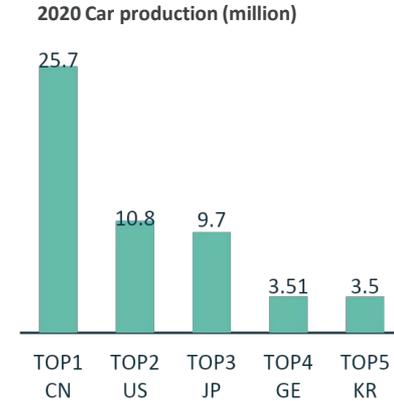
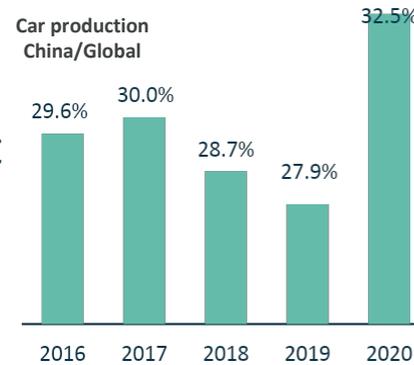
- Melexis China started in 2009
- Shanghai, Shenzhen, Taiwan , Seoul & Yokohama offices in APAC
- 50+ employees enable in-depth localized service to automotive customers
- Large and strong distribution network



# APAC

## Successes

- Revenue doubled from 2016 to 2020
- APAC represented 55% of total sales in 2020
- Large customer base: over 4000 customers in APAC
- Leadership of sense & drive technologies
- Pipeline growth: electrification, ADAS & personalization
- New product family inductive sensor is the rising star

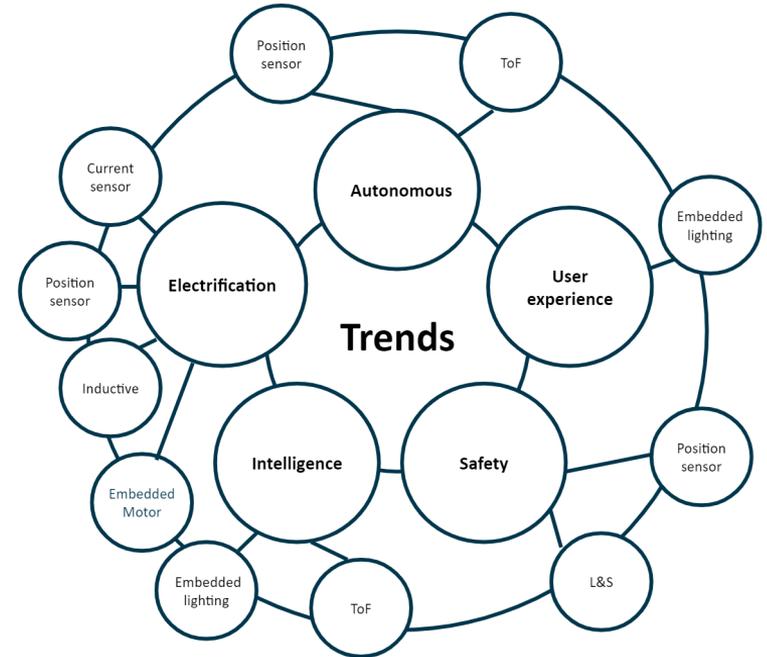


## Future

- Right people + right product @ right market = success
- Aiming for double demand creation revenue in the next years

## Trends

- China government announced a carbon peak by 2030 and carbon neutrality by 2060
- NEV is highlighted in both China's five-year plan and vision 2035 plan
- Penetration rate of NEV car reached record high 9.7% at Q1 2021
- Around 80 new ICE cars and 70 NEV (80% BEV) cars launched at 2021 Shanghai Auto Show
- HKMC's xEV sales target is set at 1.67M cars by 2025 as Big3 xEV supplier
- OEMs attract end customers by improving user experience, comfort, safety and car intelligence



# NALA

## History

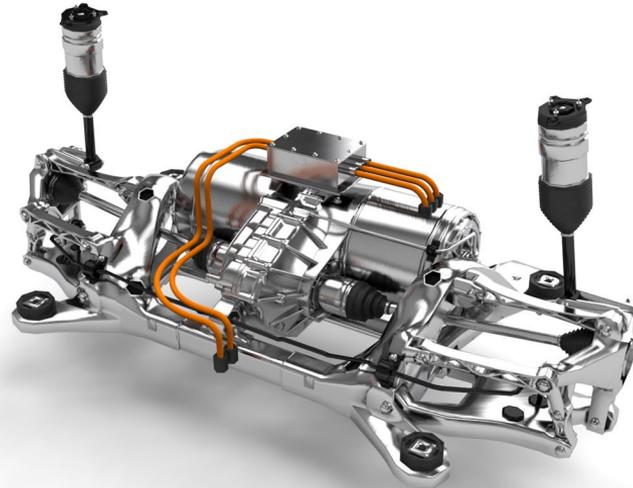
- Detroit office in 2006
- 50% of team on mainstream automotive
- Supported by large network of best in class representatives



# NALA

## Successes

- Foundation in traditional ICE applications
- Cadillac lighting
- Daimler PHEV Inverter, JLR PHEV
- Deep application knowledge of mechatronics
- Continue to find small innovator companies when they are young and grow with them for mutual success



## Trends

- EV is speeding up
- ICE slower refresh rate
- Smart pickup trucks (dynamic scale on bed and hitch)
- Smart automotive closures
- ASIL drives need for redundant sensors
- ADAS requires closed loop systems
- Personalized restraint system TOF



# MELEXIS ICs SHAPE THE FUTURE



## PEOPLE

USER EXPERIENCE

SAFETY

HEALTH



# Adjacent - From 10 to 20 (%Revenue) – How?



## Carbon-neutral

*smart appliances, smart buildings, non-fossil energy, smart metering,...*



## Alternative Mobility

*2-3 wheelers, e-mobility, micro-delivery, robotaxis, AGVs...*

## Well-being

*health, medical, wearable, gaming...*



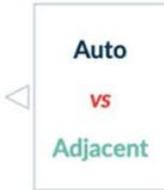
## Robotics

*automation, assisting, social interaction...*



## Computing & Networking

*cooling, power management...*



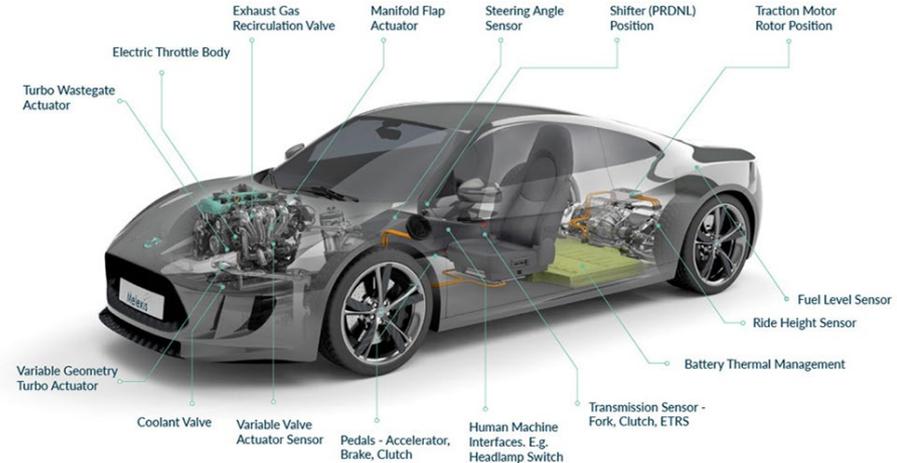
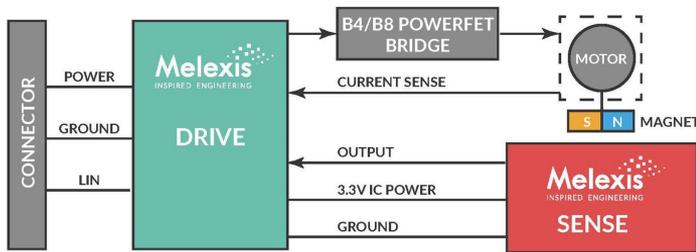
# Health: Temperature Sensors

- Joris Roels, marketing manager
  - Temperature sensing applications in
    - Wearables
    - Medical
    - Smart buildings
    - Home appliances
    - ... automotive (electrification/in-cabin thermal monitoring)
- Positive market trends, accelerated by COVID-19



# User experience & Safety: Position Sensors

- Nick Czarnecki, global marketing manager
  - Automotive
    - Body & Chassis
    - Electrification
  - Alternative mobility
  - Gaming...



# Automotive - From 10 to 20 (ICs/car)

**Master Networked Lighting**

*Interior & Exterior*

**CHASSIS - BODY - SAFETY**

**Serve Automotive Innovation**

*Mechatronic, Intelligent Vehicles*



**Total Available Market for Melexis  
(# ICs/car)**

**2020**

**28**

**POWERTRAIN**

**2025**

**43**

**87**

**CHASSIS-BODY-SAFETY**

**137**



# User experience: Embedded Lighting

- Michael Bender, product line manager
  - Interior lighting
    - LIN & CAN  $\Rightarrow$  MeLiBu™
    - Scalable architecture
  - Exterior light (surrounding)



MeLiBu™  
by Melexis

adaptive roof  
light application

MLX81117

SMART  
MULTI-CHANNEL  
RGB LED DRIVER

for automotive high-speed  
light animations

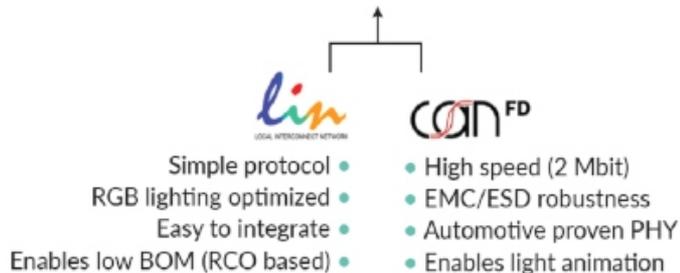
Melexis  
INSPIRED ENGINEERING

The image shows a car interior with a roof-mounted light fixture. Two beams of light are shown emanating from the fixture, illuminating the front seats. The text 'MeLiBu™ by Melexis' is in the top left, and 'adaptive roof light application' is in the top right. Below this, the product name 'MLX81117' is displayed, followed by 'SMART MULTI-CHANNEL RGB LED DRIVER' in large green letters. At the bottom, it says 'for automotive high-speed light animations' and the Melexis logo.

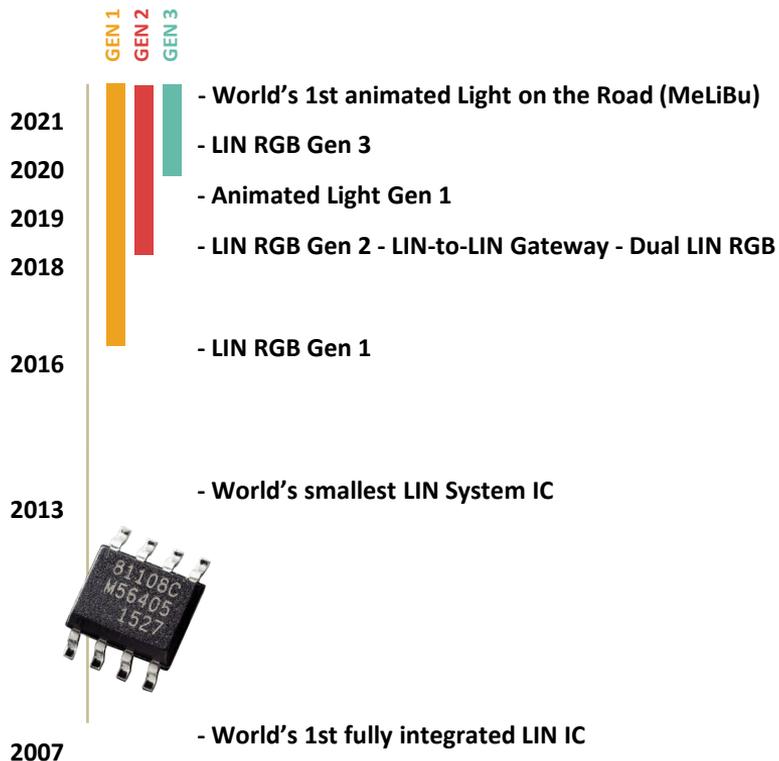
## MeLiBu™

by Melexis

= UART protocol over CAN-FD PHY



# Embedded lighting



## Key benefits

01	02	03	04
Fully integrated system solution with very limited external components	Small footprint through high integration factor	Full color-control by end user through high programmability	LIN and MeLiBu communication for static as well as animated lighting
ease of use	space	user experience	scalable

## Broad and growing product portfolio

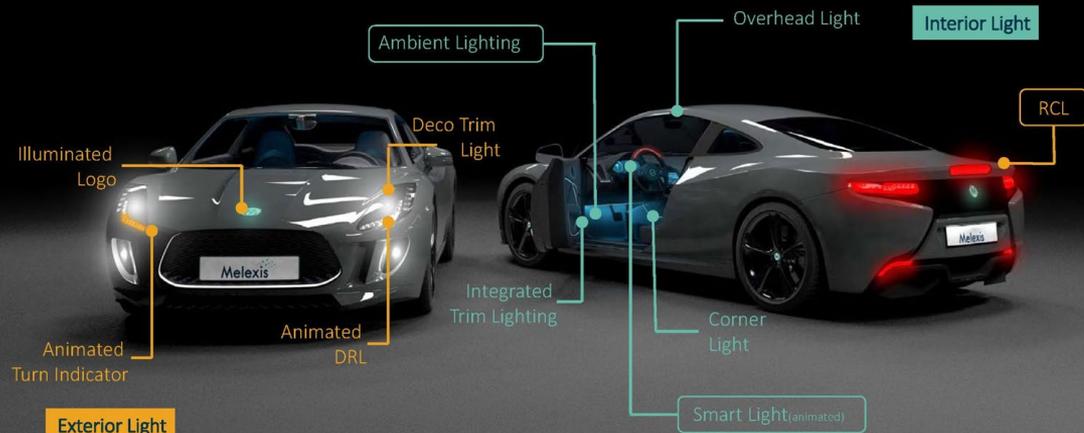
- Melexis is #1 worldwide for RGB ambient light controller ICs
- Successful re-use of system on chip integration since Gen 1
- New chip family for animated light with high speed interface (MeLiBu)
- Scalable architecture enables seamless integration for different OEMs

# Embedded lighting



## Lighting Applications

containing Melexis ICs - all LED applications requiring Smart Intelligent LED Drivers



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Melexis



# Embedded lighting



MLX81117



SMART  
MULTI-CHANNEL  
RGB LED DRIVER

for automotive high-speed  
light animations

Melexis  
INSPIRED. ENGINEERING

# Embedded lighting



## Conclusion

- 1 Full programmability inc. OTA (over the air) updatability through integrated flash based microcontroller
- 2 High Speed communication Interface (MeLiBu) enables light animations for extended user experience including new safety use cases
- 3 Broad fit for automotive interior and exterior lighting applications for all OEMs
- 4 Scalable Architecture enables full scalability of lighting applications for different OEM use cases

MeLiBu™

by Melexis

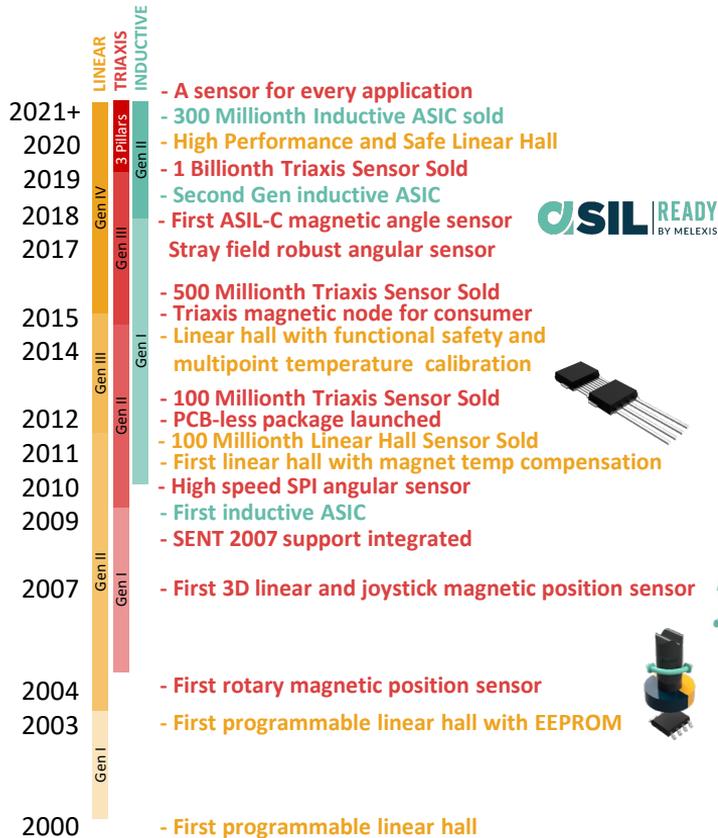
= UART protocol over CAN-FD PHY



- Simple protocol
- RGB lighting optimized
- Easy to integrate
- Enables low BOM (RCO based)
- High speed (2 Mbit)
- EMC/ESD robustness
- Automotive proven PHY
- Enables light animation



# Magnetic position sensors



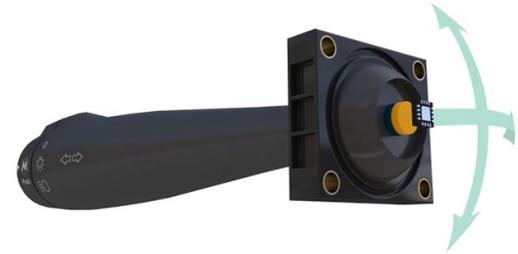
## A sensor for every application

- Functional safety (ASIL) capability enables integration into safety-conscious applications like steering and braking solutions
- Stray field robust magnetic mode allows for growing together with the increasing number of electrified vehicles
- Unique packaging options (PCB, PCB-less) enable meeting customer size, shape and weight requirements from large trucks to small personal transports

# Magnetic position sensors



## Value optimized sensing



## Fit for adjacent markets

- “Micro” magnetic sensors enable new configurations in gaming, security, and alternative mobility
- High safety rating for automotive translates to a high safety rating in industrial markets for use in robotics, material handling equipment, and heavy vehicles

Home-security

Designed for cost effective position sensing applications

MICROPOWER TRIAXIS® 3D MAGNETOMETER

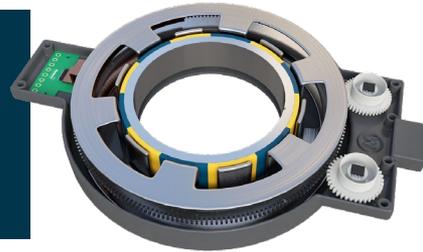
MLX90392

Melexis  
INSPIRED. ENGINEERING

# Magnetic position sensors

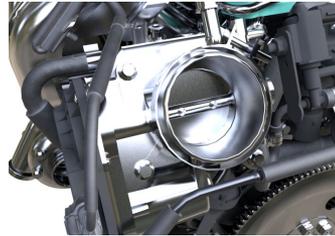


## Mainstream sensing



## Fit for adjacent markets

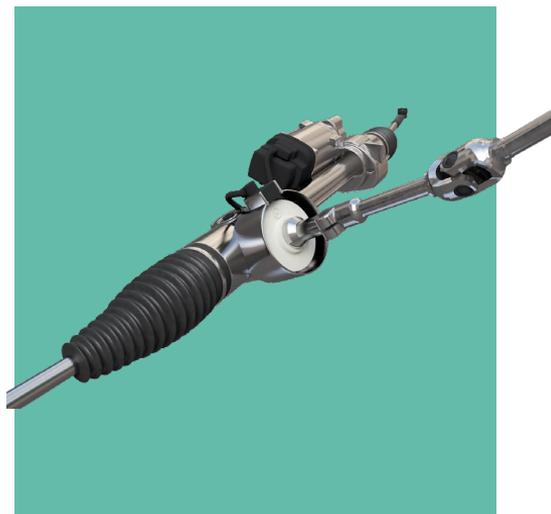
- “Micro” magnetic sensors enable new configurations in gaming, security, and alternative mobility
- High safety rating for automotive translates to a high safety rating in industrial markets for use in robotics, material handling equipment, and heavy vehicles



# Magnetic position sensors



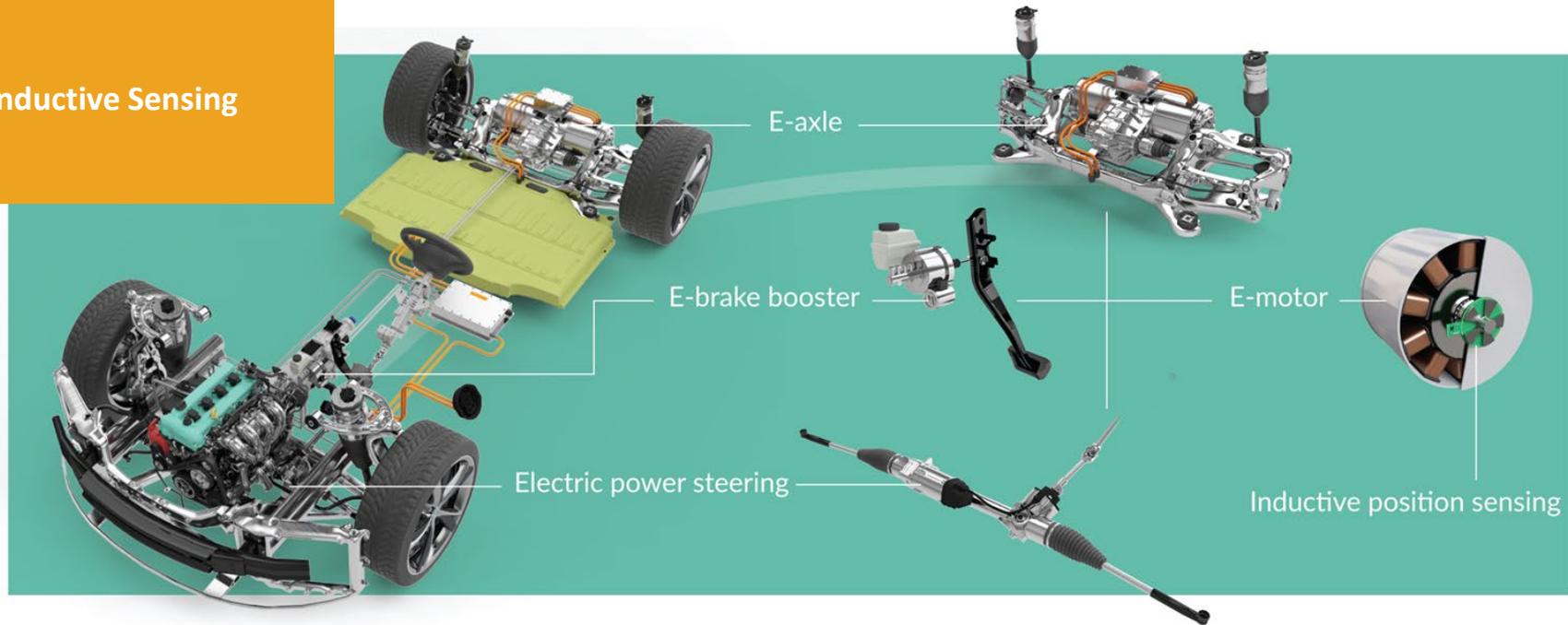
Performance sensing



# Magnetic position sensors



## Inductive Sensing

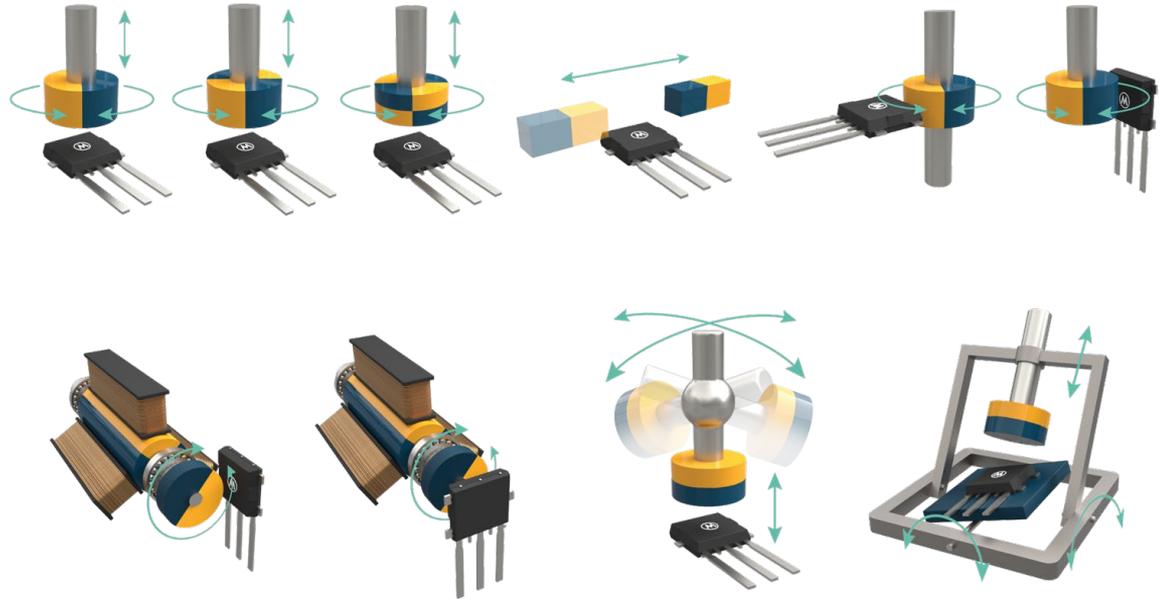


# Magnetic position sensors

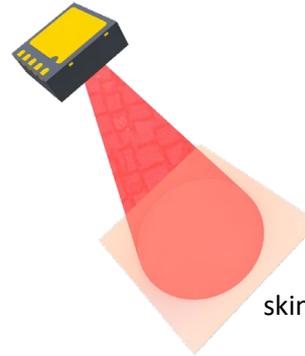
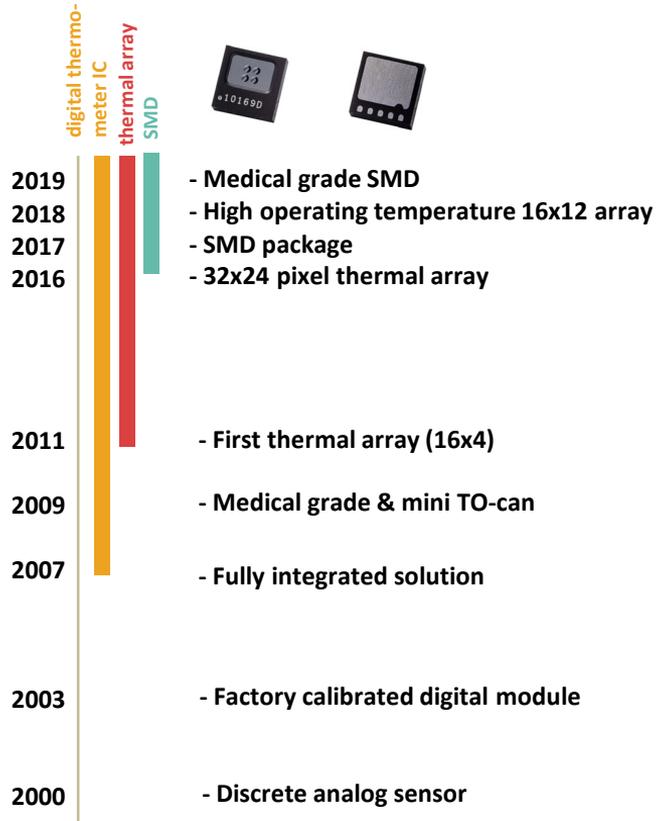


## Conclusion

- 1 Expanding portfolio for nearly every position sensing application from value optimized to high performance
- 2 Best in class performance angle sensors for demanding safety critical applications in automotive, industrial, and aerospace
- 3 Focused on the future to support electrification, safe driving, and adjacent market trends and requirements



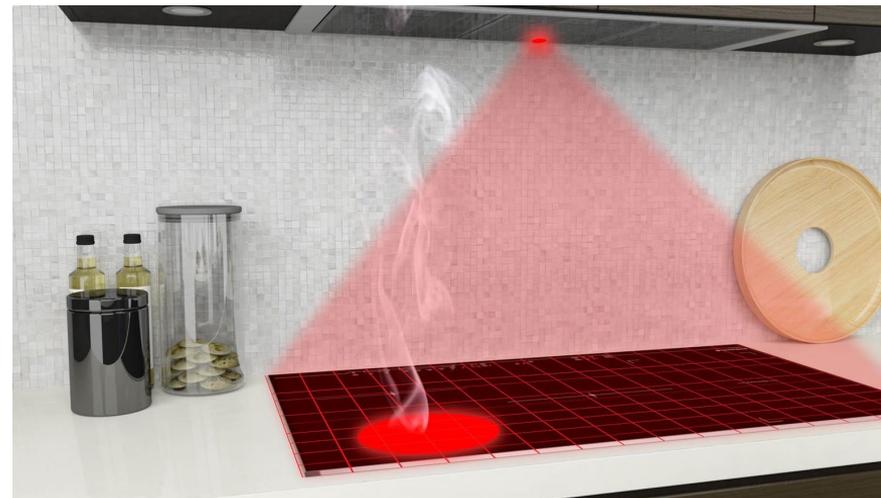
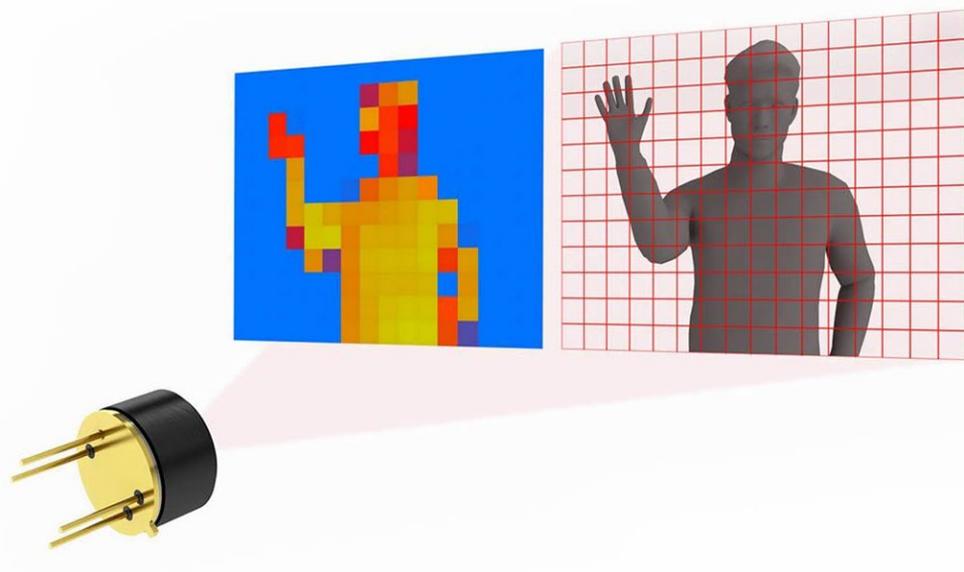
# Temperature sensors



## Non-contact temperature sensing

- Single pixel and thermal arrays
- Factory calibrated accuracy
- World's smallest medical grade
- Cost efficient thermography for people detection/screening in smart buildings

# Temperature sensors



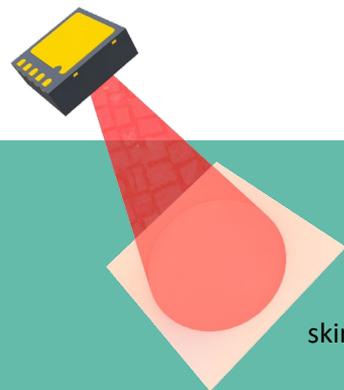
# Temperature sensors



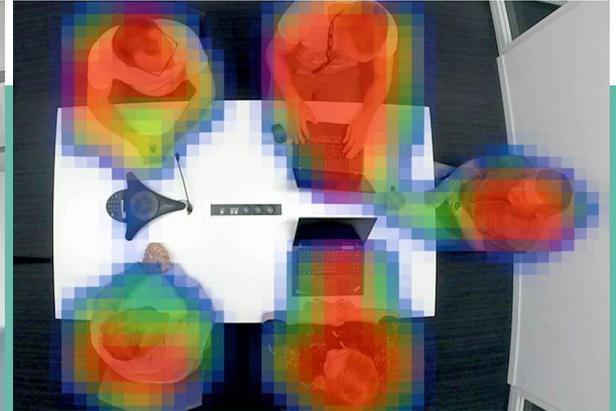
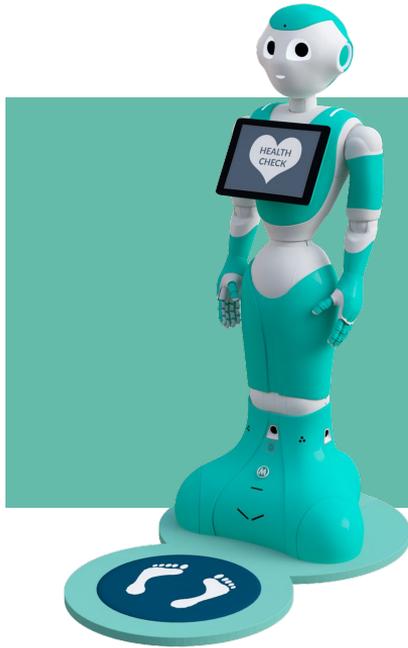
Selected Sense products

- MLX90632  
QFN package
- MLX90614  
TO-can package

# Temperature sensors



# Temperature sensors



# Temperature sensors



## Conclusion

1

Oriented towards adjacent: health & smart building

2

Personal health & well-being = sustainable market, strongly accelerated by COVID-19

3

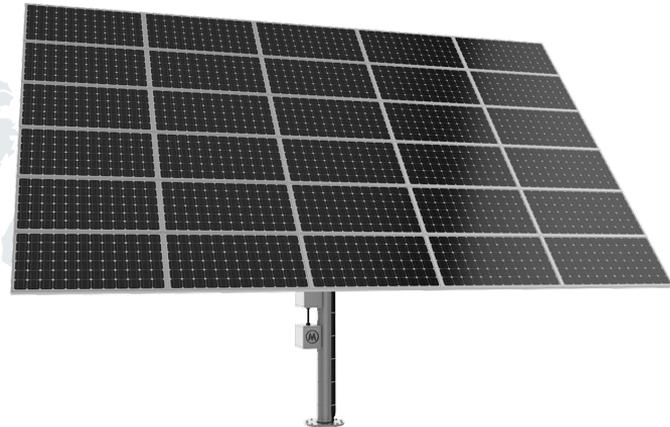
Unique product offer: miniaturization and factory calibrated accuracy



# APAC

## Successes

- Adjacent market: growth 50% vs. 2019
- Market leader FIR sensor, smart motor driver
- Growth of current sensor in industrial, solar inverter
- Potential of latch & switch in home appliances
- Access control system: high demand for FIR sensor
- Successful project with SMD FIR sensor at top mobile phone maker
- Wearable makers adding FIR sensor



## Trends

- COVID-19 changed our lives, temperature sensing becomes important for people health and environment
- APAC HVAC production contributes 85+% share in worldwide/1720Mu in 2020
- IOT Smart home market will hit \$157B by 2023
- Home appliance smart trend, larger demand for sensor
- China aims for 300GW of new solar PV capacity between 2021 to 2025, compare cumulative 208GW until 2020



# NALA

## History

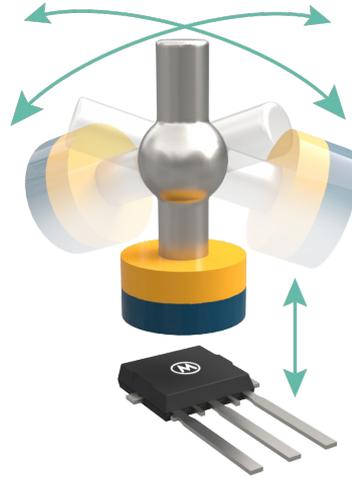
- Start 2003
- 50% of NALA team
- Growth from 0 to 33% share of pipeline in 6 years
- Silicon Valley Office open for 3 years
- Strong in industrial, medical, prosumer



# NALA

## Successes

- Industrial joysticks
- Smart building — smart glass temperature monitoring and smart locks
- Medical — “Doc in the box” medical appliances
- Test - hard disc drive bulk test
- Maker market — 3D printer — temp and position



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Image: medwand.com

## Trends

- Continuous health monitoring
- Micro-utilities: neighborhood is microgrid
- Logistics: last 100 feet delivery robots
- Autonomous driving: startups and FAAMG
- Prosumer temperature sensing devices driven by COVID-19



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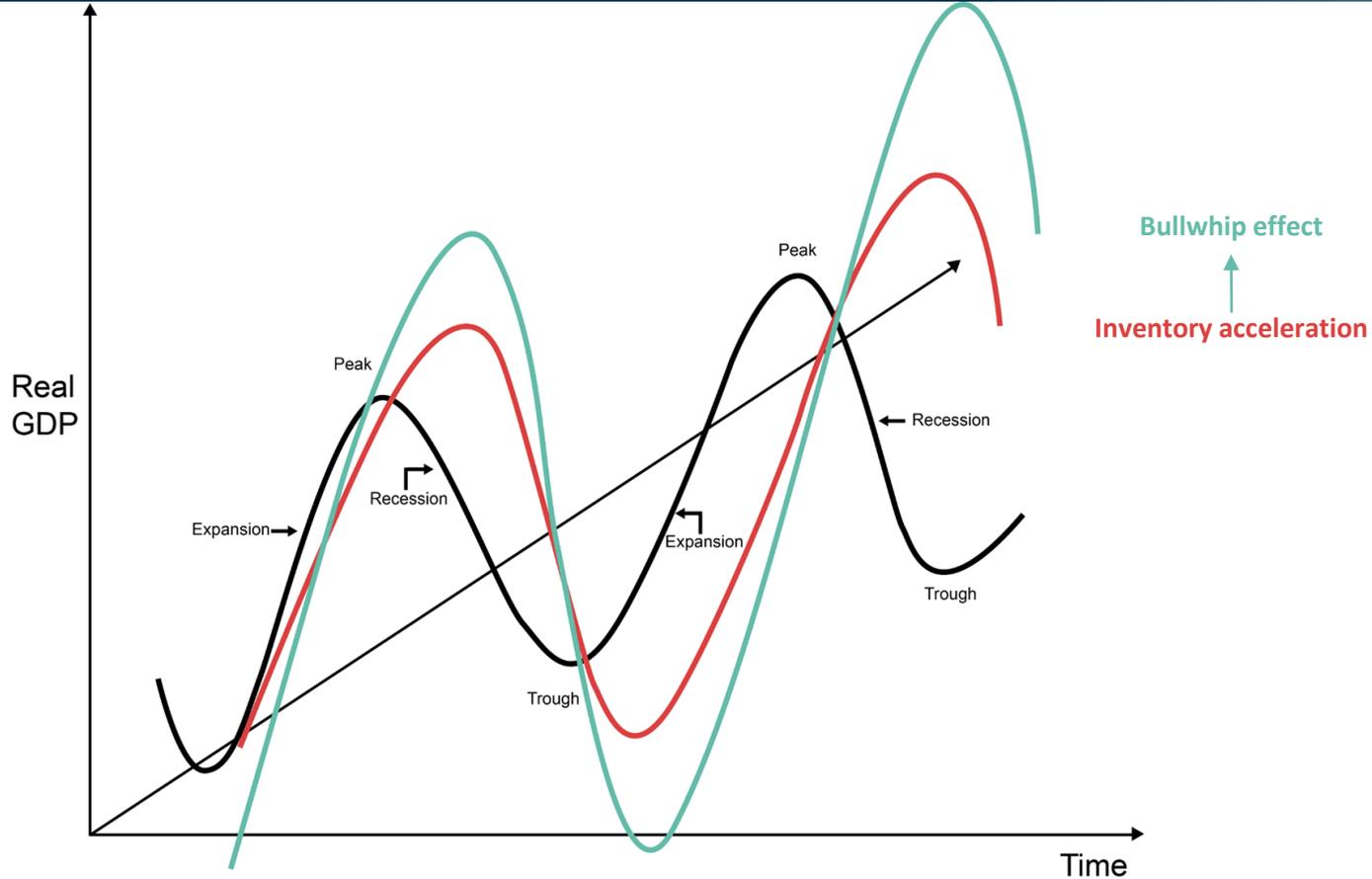


## Trends

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- Micro-utilities: neighborhood is microgrid
- Logistics: last 100 feet delivery robots
- Autonomous driving: startups and FAAMG
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# Inventory acceleration effect (aka bullwhip effect)



# Keeping a close eye on the overall market situation

## Global shortage in computer chips 'reaches crisis point'

The global chip shortage is a much bigger problem than everyone realised. And it will go on for longer, too

The semiconductor shortage is here to stay, but it will affect chip companies differently

## Why We're in the Midst of a Global Semiconductor Shortage

## Reimagining the Semiconductor Supply Chain to Prevent the Next Chip Shortage

## How Covid led to a \$60 billion global chip shortage for the auto industry

A fundamental rethink of the approach used by automotive and industrial players toward semiconductors can help boost supply chain resilience.

## Semiconductor shortage will hit auto industry well into 2021

## Global Chip Shortage Set to Worsen for Car Makers

# Complex automotive supply chain

OEM



Tier 1



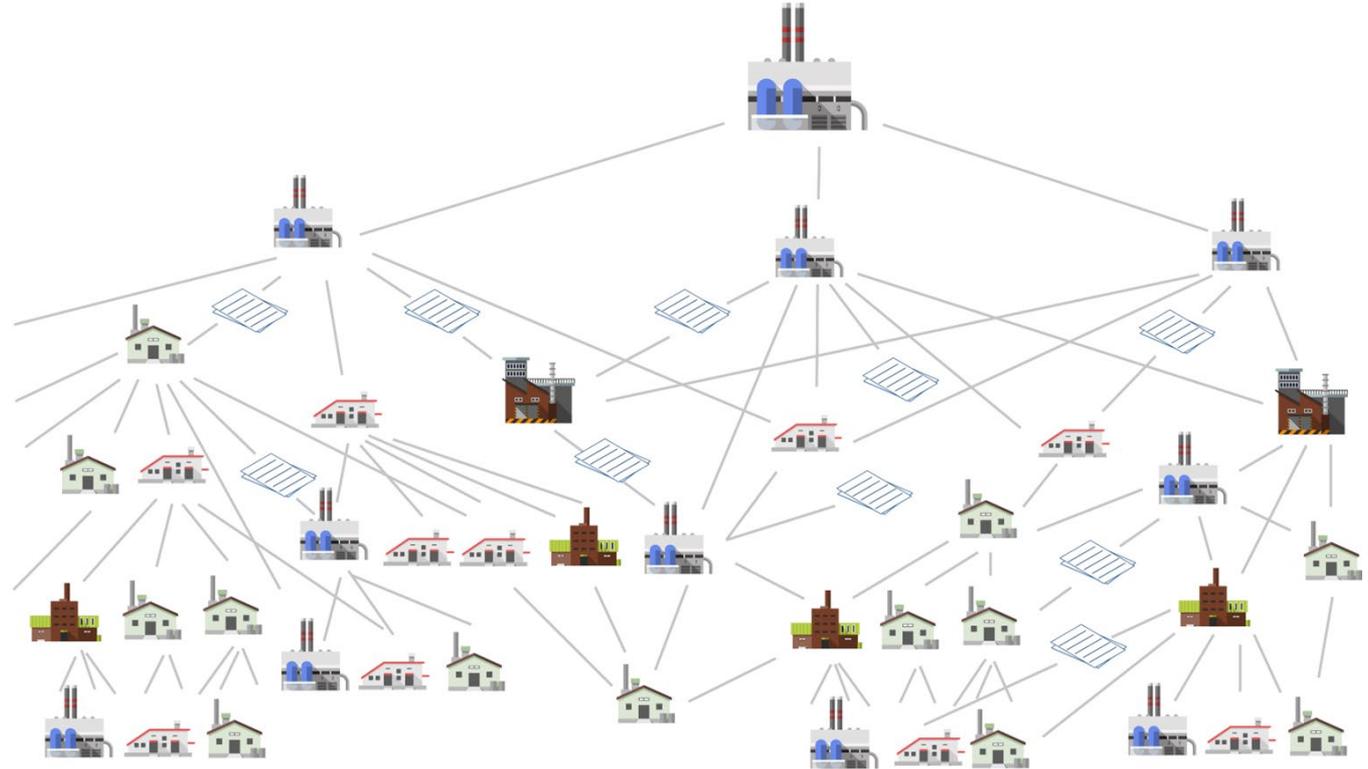
Tier 2



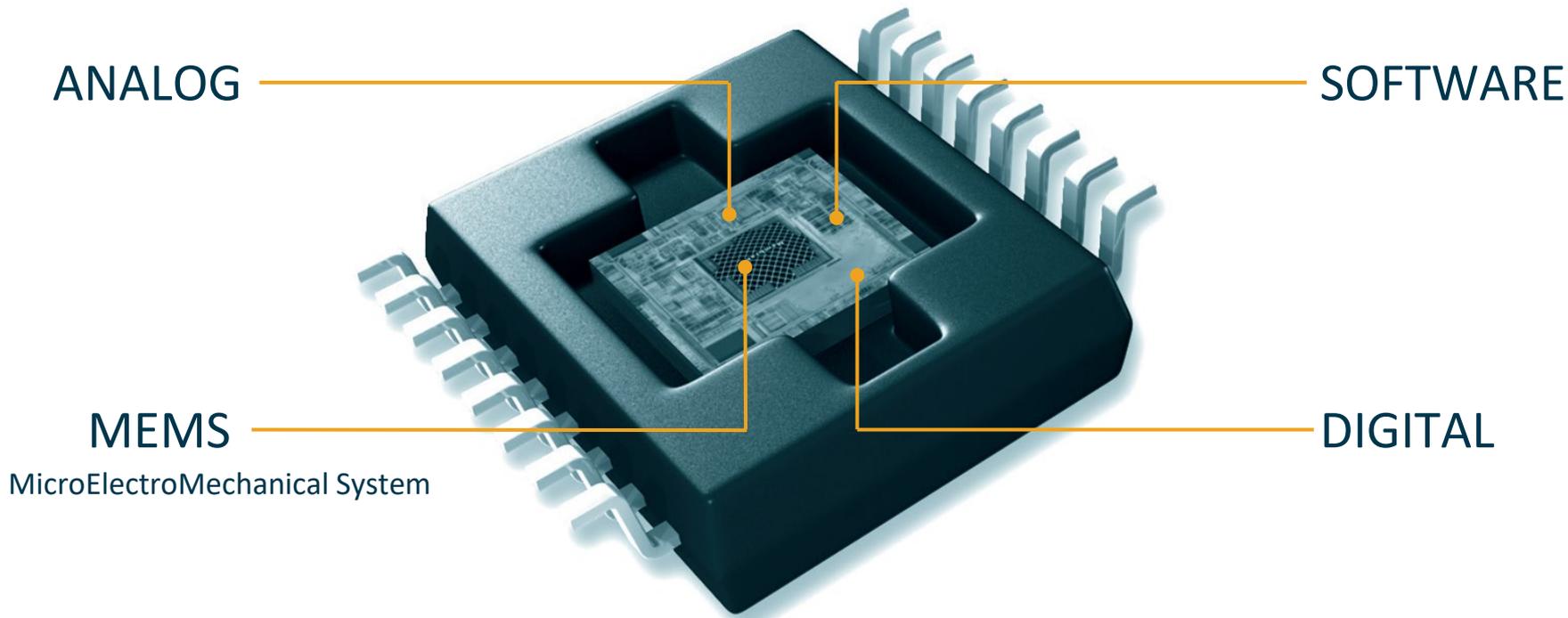
Tier 3



Tier 4



# ICs integrate key expertises



AND MORE...

# Melexis sensors and drivers



- Magnetic position sensors
- Inductive position sensors
- Current sensors
- Latch & switch
- Embedded drivers
- Smart drivers
- Pressure sensors
- Tire monitoring sensors
- Temperature sensors
- Optical sensors
- Sensor interfaces
- Embedded lighting



# MELEXIS ICs SHAPE THE FUTURE



## PLANET



ELECTRIFICATION



MICRO MOBILITY



THERMAL MANAGEMENT



# MELEXIS ICs SHAPE THE FUTURE



## PEOPLE

USER EXPERIENCE

SAFETY

HEALTH



# New building Melexis Sofia

